Pelham Lake

Survey and Management Recommendations Report

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Prepared by: SŌLitude Lake Management

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Introduction
In accordance with the existing aquatic plant management contract between SŌLitude Lake Management (formerly Lycott Environmental) and the Town of Rowe for Pelham Lake, the following document serves to provide the 2014 vegetation and bathymetric survey results and management recommendations for control of future nuisance bladderwort (*Utricularia* spp.) growth.

Point-Intercept Survey
On August 14, 2014, biologists completed the point-intercept survey at Pelham Lake. The pre-determined 50 points, based on an overlaid 80m grid, were surveyed and at each the water depth, species present, dominant species, percent cover, and biomass index were identified.

Purple bladderwort (*Utricularia pupurea*) and intermediate bladderwort (*Utricularia intermedia*) were the dominant species throughout the points, being found at 78% and 50% of the locations, respectively. They were found together at 22% of the points; however, purple bladderwort was noticeably more dense than intermediate bladderwort. Although primarily in trace densities, waterweed (*Elodea* spp.) was found at 40% of points. Other species observed (in decreasing prevalence) included: watershield (*Brasenia scherberi*), quillwort (*Isoetes* sp.), bur-reed (*Sparganium* sp.), other bladderwort species (*Utricularia* spp.), tapegrass (*Vallisneria americana*), and various pondweed species (*Potamogeton* spp.).

The biomass index is the scale in which the average plant height within the water column is measured upon. 0 = no biomass, no plants; 1 = low biomass, very low growth; 2 = moderate biomass, growth extending up into water column; 3 = high biomass, growth in water column and possibly to surface, may be considered a recreational/habitat nuisance; 4 = growth filling the water column and covering the surface. The average biomass for the 50 points at Pelham Lake was 2.26, indicating moderate biomass and some growth extending into the water column.

Percent cover is the percent of the bottom sediment that is obscured by vegetation. Areas with no sediment visible are classified as 100% cover. Average percent cover was 72.9%, indicating that vegetation was moderate to dense through a majority of the waterbody.

A copy of the data table showing all of the above information is attached in Appendix A. Further, maps representing the data are also attached in Appendix A.

Littoral Survey
On August 15, 2014, biologists performed a survey of the littoral zone, the area of the lake where enough light penetrates to allow plant growth. This area was surveyed to identify areas with nuisance plant growth that could not be observed beyond the point-intercept locations. A rake-toss was done at each of the 82 systematically chosen points through the littoral area. Again, species and dominant species present were noted.

Watershield was the most prevalent species found, while purple bladderwort was the densest among species observed. Other species included: intermediate bladderwort, bur-reed, white and yellow waterlilies (*Nymphaea odorata, Nuphar variegata*), pondweed species, and tapegrass. As watershield is often found in shallower, protected waters, it was expected to be abundant within the littoral zone. Further, as purple bladderwort was the dominant species at the point-intercept locations, it was also expected to be present and abundant here.

Water Quality

Water samples were collected from five pre-determined locations (Potter Brook, Pelham Brook, Deep Hole, Open Water, Storm Drain) in or around Pelham Lake to document the level of nutrients available to the plant community, as well as other parameters to assess the habitat's support for aquatic life. Overall, water quality in Pelham Lake was found to be great, with low nutrient levels and all parameters falling within appropriate ranges. Brief descriptions of each parameter and their results are as follows.

Alkalinity: A measure of the buffering capacity of water, primarily consisting of carbonate, bicarbonate and hydroxide in typical freshwaters. Waters with lower levels are more susceptible to pH shifts (≤ 50 mg/L low buffered, 51-100 moderately buffered, 101-200 buffered, >200 high buffered).
Results ranged from 3.1 – 8.98 mg/L, showing low buffered waters.

Ammonia: Rich in nitrogen and can contribute to algae growth. It is toxic to fish, even at very low concentrations (≥ 0.06 mg/L can cause damage to fish, > 0.1 mg/L indicates polluted waters).
Results ranged from <0.050 – 0.210 mg/L, showing that while some sampled locations had very low results, there were locations with results indicating possible pollution. Elevated ammonia concentrations could also be caused by decomposing organic material.

Nitrate: The sum of total oxidized nitrogen, often readily available for algae uptake (< 1 mg/L typical freshwater, 1-10 potentially harmful, > 10 possible toxicity and above many regulated guidelines).
Results were all ND, non-detect by laboratory analysis, and thus were less than <0.100, showing that all locations had nitrate levels within typical freshwater limits.

Phosphorus: The essential nutrient often correlating to the growth of algae in freshwaters and the measure of all phosphorus in a sample, which includes what is readily available, potentially to become available, and stable forms. (< 0.012 mg/L low nutrients/oligotrophic conditions, 0.012 – 0.024 mg/L moderate nutrients/mesotrophic, 0.025 – 0.096 mg/L abundant nutrients/eutrophic, and > 0.096 mg/L excessive nutrients/hypereutrophic).
Results ranged from <0.010 – 0.015 mg/L, showing that low and moderate levels of phosphorus were present in sampled locations, representing oligotrophic and mesotrophic conditions.

pH: A measure of how acidic (< 7) or basic (> 7) the water is. (pH 7 is considered neutral.)
Results were all 7.0, showing the water was neutral.

Temperature: The measure of how warm or cold the water is, which is highly dependent on the season and weather.
Results were all normal and expected for the time of year that the samples were collected.

Dissolved oxygen: The amount of free oxygen molecules present in the water. This amount can vary depending on temperature, depth, seasonality, flow, etc. (< 3.0 mg/L is too low for fish populations, > 7.0 mg/L supports fish growth and activity, > 9.0 supports abundant fish populations).
Results ranged from 7.53 – 8.49 mg/L, showing that all locations support healthy fish growth and activity.

Secchi Disk depth: The Secchi Disk is a standard measure of the clarity of the water. Algae and suspended particles are often the reasons for lack of clarity, thus the lower the Secchi depth, the lower the water clarity.
Results ranged from 2.5 – 2.75 m, both of which were at the bottom for their respective locations, showing that clarity was excellent as the bottom was easily visible from the surface.

Copies of both laboratory results for the samples are attached, as well as a table documenting all lab and in situ results in Appendix B.

Bathymetry and Biovolume Survey

During November 2014, the bathymetric survey was performed using a 16-foot boat equipped with a high-definition sonar/depth-finder unit. Using pre-determined transects, the lake was toured to collect both depth and vegetation composition throughout the waterbody. The data collected was then processed using ciBioBase software to show the biovolume of the plant growth present in the lake at the time of the survey, as well as the depth contours of the entire lake. Biovolume ultimately shows the vegetation density, with blue being 0% increasing to red or 100%. Thus, the more blue, the more open water and less vegetation. Please note, the biovolume data was collected in late November, so vegetation density is expected to be lower than during summer months as plants are dying or have died.

Both biovolume and bathymetric maps are attached in Appendix C.

Padgett Environmental Surveys

In accordance with Massachusetts Natural Heritage and Endangered Species Program, Pelham Lake was surveyed to assess the Farwell's watermilfoil (*Myriophyllum farwellii)* population in order to help minimize any impacts to the species by potential lake management activities. The surveys were performed by Donald J. Padgett, Ph.D, of Padgett Environmental Services of Middleboro, MA, during July/August of 2010, and August of 2015.

In the 2010 survey, four locations were identified to have Farwell's watermilfoil colonies, which had healthy plants with abundant fruits present. All locations were within "west-facing protected coves;" three of the locations were along the eastern shoreline, while the fourth was on the western side of the lake.

In the 2015 survey, Farwell's milfoil was again located within Pelham Lake, however only within one location. This location corresponds to a previously identified location on the western shore, adjacent to the outlet. The colony had approximately 20 healthy individuals with mature fruits. As no individuals were found along the eastern shoreline, this area was re-surveyed multiple times to ensure no plants were overlooked; however, none were ever identified.

Copies of each report from Padgett Environmental Services are attached in Appendix D.

Management Recommendations

Although bladderwort species are often indicators of very good water quality, they have the potential to grow to nuisance levels, as in the case at Pelham Lake. The bladderwort species found in Pelham Lake are considered to be native plants, but they are known to experience "boom and bust" growth cycles, where some years it may be dense and floating everywhere while some years it may maintain low growth along the bottom and not be noticeable from the surface. Aside from Pelham Lake, we have experienced this phenomenon in other lakes throughout Massachusetts. Unfortunately, there is no way to predict which years will result in more growth than others, which can present potential management challenges.

The following are potential management options to control future nuisance growth of bladderwort, both chemical and mechanical.

If any aquatic plant management is to be done at Pelham Lake, a Notice of Intent (NOI) would have to be filed with MA Department of Environmental Protection (MA DEP), which is subject to approval from that office, and then the Town of Rowe Conservation Commission. In addition, since Pelham Lake is mapped as a MA Natural Heritage and Endangered Species Program (NHESP) Priority Habitat area, NHESP approval would have to be received prior to filing the NOI with MA DEP. Upon complete approval from all parties, an Order of Conditions (OOC) would be issued, for three or five years. Cost for filing an NOI would be approximately $2,500 - $3,000 plus up to $1,000 for direct expenses (i.e. abutter mailings, filing and bylaw fees, postage, etc.).

Aquatic herbicides could be used to effectively manage nuisance bladderwort growth in Pelham Lake. If whole lake management were desired, the systemic herbicide fluridone (trade name: Sonar) would be the most effective herbicide for a large-scale treatment. Fluridone generally provides multiple years of nuisance-level control and it can be highly selective by manipulating dose and exposure time, which may allow for the reestablishment of different native plant cover. Fluridone works by preventing a plant from producing carotene, which protects chlorophyll from photodegradation; so susceptible plants appear to bleach-out (a process called chlorosis) as chlorophyll is degraded Further, fluridone has one of the most environmentally friendly toxicology profiles of herbicides currently registered for aquatic use. Ideally, fluridone applications are initiated early in the growing season when target plants are beginning to emerge and an extended concentration-exposure-time is required, typically 45-60 days which involves follow-up or "booster" applications. However, since several milfoil species are susceptible to fluridone, it could impact the Farwell's watermilfoil currently present in Pelham Lake. One possibility would be to use limno-barriers (floating curtains) to isolate and protect areas where the Farwell's milfoil is present. The limno-barriers could be installed prior to treatment and removed once the herbicide concentrations drop below levels that may injure the Farwell's milfoil. This strategy would be subject to permit approval from NHESP, and would incur additional costs for barrier rental, installation and removal, and for the associated herbicide residue sampling that would likely be required. Cost for a whole-lake fluridone treatment would be approximately $30,000 – $35,000.

Another herbicide option is the use of diquat (trade name: Reward), which is a contact herbicide that interferes with the plant's photosynthesis. This herbicide is effective for partial-lake and spot-treatments due to its rapid mode of action and short concentration-exposure-time requirements. Upon contact with soil, diquat is adsorbed immediately and thereby biologically inactivated. As diquat is only a contact herbicide, bladderwort control would likely only last for one year, and treatment would need to be performed in following years if conditions required it. For better efficacy, the diquat would be tank-mixed with a copper product to help with penetration into the plant cells. However, bladderwort treatment with diquat can have varying results due to the nature of the bladderwort plants. If diquat were to be used at Pelham Lake, a five (5) acre area around the beach would be treated. Cost for five acres to be treated with diquat and copper would be approximately $4,000 - $5,000.

Flumioxazin (trade name: Clipper) is the third herbicide option for potential bladderwort management at Pelham Lake. This herbicide is a contact herbicide and an oxidase inhibitor that initiates cell membrane disruption, thus providing control to a broad range of plants. Flumioxazin has only been registered for aquatic use in Massachusetts for a few years, so its use has a number of restrictions at this time. In order to limit potential non-target damage, the State requires that no more than ¼ of the water body may be treated in any one year with flumioxazin and treated areas cannot be repeated for three (3) consecutive years to prevent herbicide resistance. However, an exception is made in which treatments in areas around shoreline structures (i.e., boat launches, docks, beaches, dams, etc.) can be treated for consecutive years. Therefore, a five-acre area around the beach could be treated in consecutive years with flumioxazin, if necessary. Flumioxazin is probably the best herbicide currently

registered for spot-treatment of the beach area. Cost for a five-acre beach area flumioxazin treatment would be approximately $6,000 - $8,000.

Mechanical options are also available for physical removal of bladderwort plants. From our understanding, hand-pulling for removal of bladderwort from within/around the beach area was one permitted at Pelham Lake. Although this may be an effective removal technique, it may only provide temporary relief from nuisance conditions due to the floating tendencies of bladderwort. Diver-assisted suction harvesting (DASH), although also potentially effective but temporary, this technique is often very expensive with costs of $5,000-$15,000 per acre regularly reported. As both of these options have short-lived outcomes, we do not recommend pursuing them.

Mechanical harvesting is performed with a floating barge mobilized by two hydraulic wheels, with a front conveyer that collects aquatic vegetation cut from the cutting mechanism beneath. The cut vegetation is then transferred from the front conveyor to a larger back storage conveyor beneath the operator's platform. As the back conveyor reaches its storage capacity, the collected material is offloaded, either into a container or to be removed to a designated area. A typical day of harvesting removes 1 to 2 acres, depending on site-specific circumstances. This option would be used for harvesting bladderwort around the beach area, and we would again recommend an area of five to ten acres to be harvested, or approximately one week worth of removal work. Some potential advantages of harvesting over herbicide treatments are that the biomass (and nutrients) are removed from the lake, it can be area-selective and areas harboring state-protected species can be easily avoided, and it does not carry the negative stigmas usually associated with herbicides. The primary disadvantages are the unpredictable duration of control and the higher unit costs. An estimated cost for one week of harvesting, targeting 10-15 acres, would be approximately $10,000, assuming that the Town handles disposal of removed material once it is off-loaded on shore.

If management is desired, we ultimately recommend filing an NOI that requests approval for treatment of five acres around the beach area, preferably with flumioxazin, and contingent approval for harvesting a larger area around that, to be done in conjunction with treatment or separately. As previously mentioned, because of the Farwell's milfoil that is present, it is likely that NHESP could have comments and/or restrictions on any of the management options suggested above.

Appendix A

Point-Intercept Survey Data

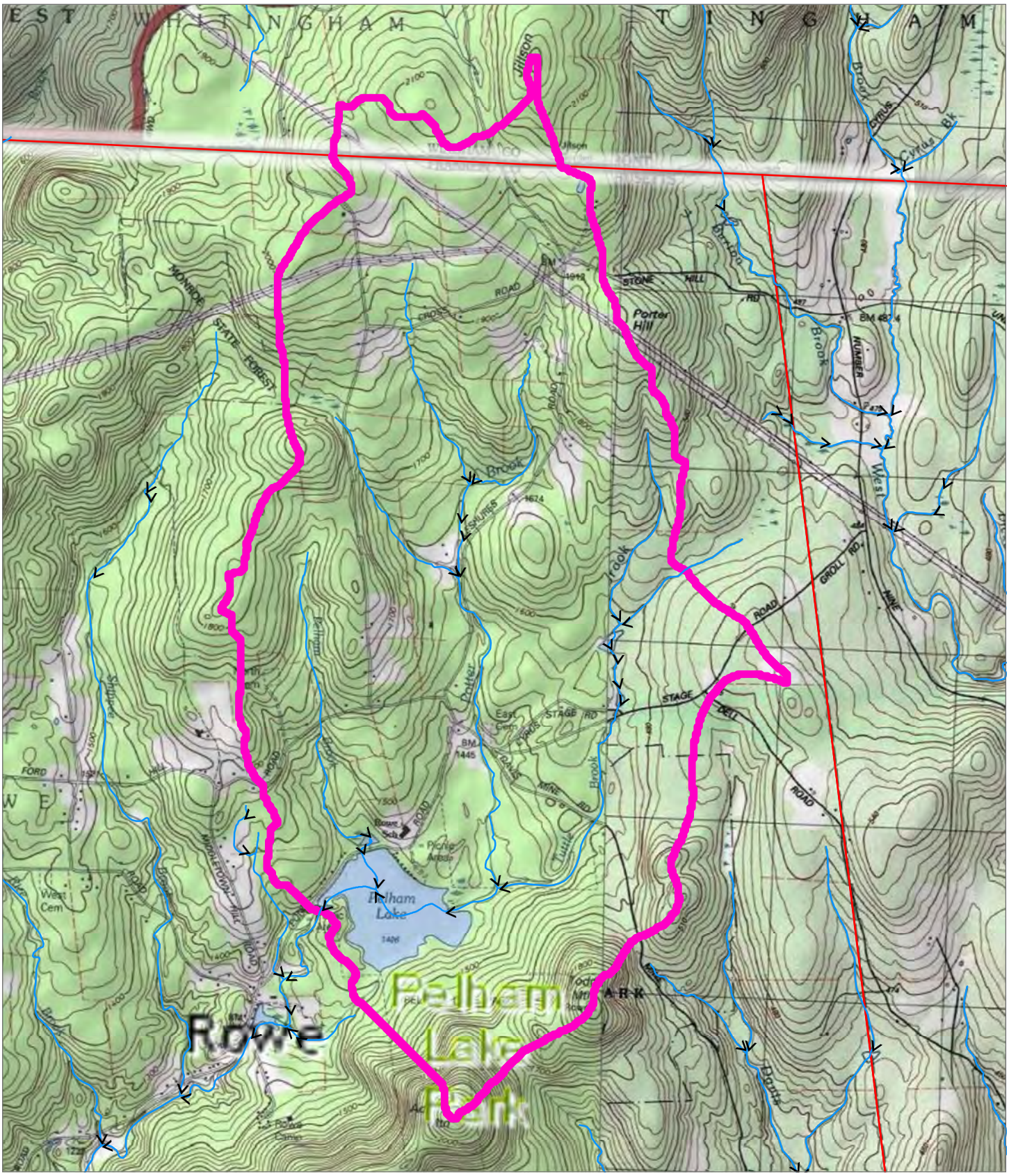
Maps

- Watershed and Tributaries
- Water Quality Sampling Locations
- Survey Point Identification Numbers
- Water Depth
- Total Biomass at Individual Survey Points
- Percent Cover of All Plant Species
- Relative Abundance of Observed Aquatic Vegetation Species
- 2014 July Distribution of *Utricularia* spp.

PT ID	LAT (DD)	LONG (DD)	Relative Abundance													BMI	% COVER	DEPTH (Ft.)
			U. purpurea	*U. intermedia*	*B. schreberi*	*Utricularia* sp.	*Isoëtes* sp.	*Elodea* spp.	*P. pusillus*	*Sparganium* sp.	*Eleocharis* sp.	*P. australis*	*P. bicupulatus*	*Potamogeton* sp.	*V. americana*			
1	42.69700367	-72.8907275	D							T						2	100	4.9
2	42.69701541	-72.88975131	D	T												2	100	4.5
3	42.69702713	-72.88877512	D		S											4	100	4.8
4	42.69772373	-72.89074341	D	T												2	100	5.1
5	42.69773547	-72.88976722	D	T												2	95	5.8
6	42.6977472	-72.88879102	D	T												2	100	6
7	42.69775892	-72.88781482	D													2	100	7.5
8	42.69843204	-72.89173554	D	T												2	95	5.2
9	42.69844379	-72.89075933	T											T		2	10	7.9
10	42.69845553	-72.88978312	D	T				T								2	100	6
11	42.69846726	-72.88880691				T		T								1	5	8.4
12	42.69847898	-72.8878307								T						1	5	7.2
13	42.69849069	-72.88685449	D				S									2	90	4.1
14	42.69850239	-72.88587828	D		T							M				4	90	3.8
15	42.69851409	-72.88490207	D													2	100	2.7
16	42.69852578	-72.88392586	D		T											4	100	1.5
17	42.6991521	-72.89175147	D	T				T								2	100	7.1
18	42.69916385	-72.89077525	D	M				T								2	100	6
19	42.69917559	-72.88979903						T								2	5	7.4
20	42.69918732	-72.88882281						T								2	20	6.9
21	42.69919904	-72.88784659	M	T				M								2	75	5.1
22	42.69921075	-72.88687037	T				T									2	40	5.3
23	42.69922245	-72.88589414	M				S									2	90	2.9
24	42.69923415	-72.88491792			T	T	M									4	55	2
25	42.69924584	-72.8839417	D		T										T	4	100	2
26	42.69987216	-72.8917674	T	S				M	T							3	40	9
27	42.69988391	-72.89079117		S			M	S								2	65	9
28	42.69989565	-72.88981494	T													2	10	8.8
29	42.69990738	-72.88883871	D	T												2	100	5.9
30	42.6999191	-72.88786247	D	T				T								2	100	5
31	42.69993081	-72.88688624	S					D								2	85	5
32	42.69994251	-72.88591001	D					S								3	80	3
33	42.7005687	-72.89373582														0	0	5.1
34	42.70058047	-72.89275957														0	0	10
35	42.70059222	-72.89178333	D	T												2	100	7.2
36	42.70060397	-72.89080709	M	T	T											2	55	8.9
37	42.70061571	-72.88983085	D	T				S								2	90	7.7
38	42.70062744	-72.8888546	M	T				T								2	70	6.3
39	42.70063916	-72.88787836	D	T												2	100	6.7
40	42.70065087	-72.88690212		T				S								2	50	5.3
41	42.70066258	-72.88592587			D		T	T								4	90	3.5
42	42.70130053	-72.89277552	M					T								2	50	8.2
43	42.70131228	-72.89179926	D	T												2	100	5.7
44	42.70132403	-72.89082301	D	T				T					S			3	100	6.3
45	42.70133576	-72.88984676	D	T				T	T							2	100	6.8
46	42.70134749	-72.8888705	D	T				T								2	80	7.5
47	42.70203234	-72.89181519	D		S											4	100	3.5
48	42.70204409	-72.89083893	D	T												3	100	3.8
49	42.70205582	-72.88986266	M													2	50	5
50	42.70277588	-72.88987857		T	T		S			S			T		T	3	55	2
		Average														**2.26**	**72.9**	**5.706**
		Frequency	**78.0%**	**50.0%**	**18.0%**	**4.0%**	**14.0%**	**40.0%**	**4.0%**	**6.0%**	**0.0%**	**2.0%**	**4.0%**	**2.0%**	**4.0%**			
		Count	**39**	**25**	**9**	**2**	**7**	**20**	**2**	**3**	**0**	**1**	**2**	**1**	**2**			

T = Trace S = Sparse M = Moderate D = Dense

Pelham Lake Watershed and Tributaries



Pelham Lake
Rowe, MA

Map Prepared: 04/25/2014
For Town of Rowe
Basemap © 2013 Esri

N

0 250 500 1,000
Meters

SOLITUDE LAKE MANAGEMENT

Water Quality Sampling Locations

Pelham Lake
Rowe, MA

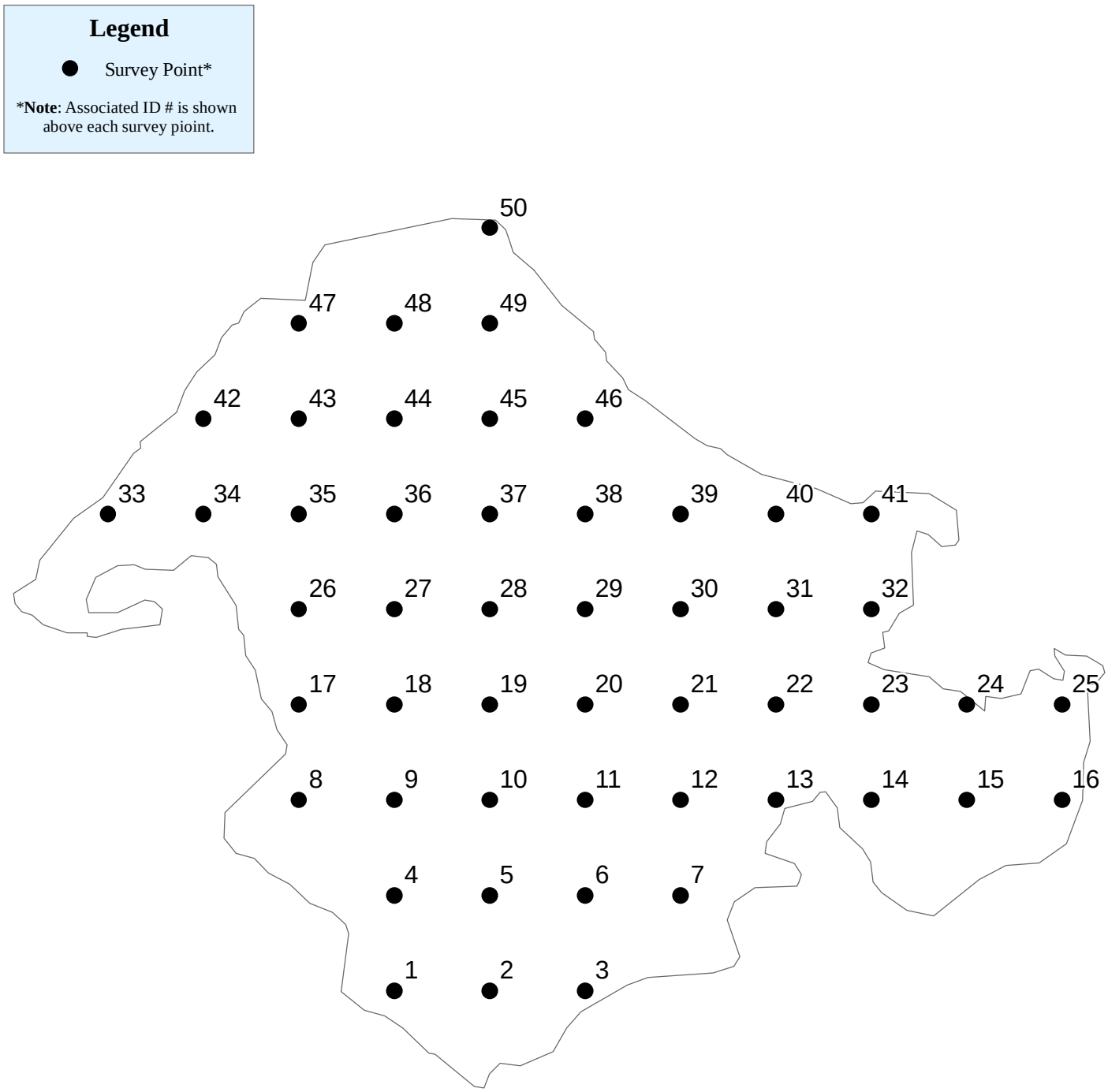
Map Prepared: 10/02/2014
For: Town of Rowe
Basemap © 2013 Esri

0 250 500
1:5,000 Feet

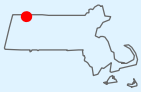
N

SOLITUDE
LAKE MANAGEMENT

Survey Point Identification Numbers



Pelham Lake
Rowe, MA



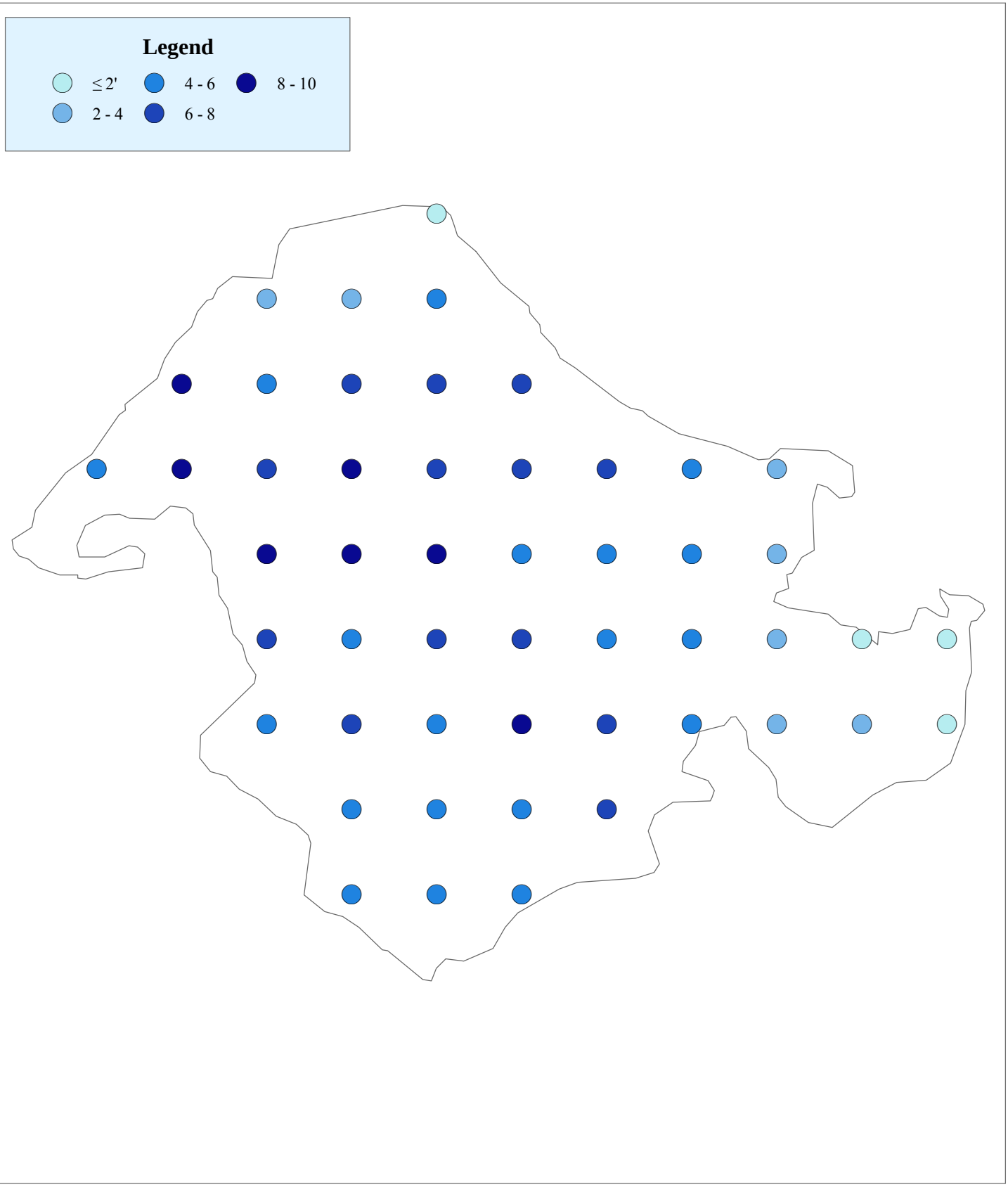
Map Prepared:5/5/15
Date Collected: 8/14 & 8/15/14
For: Town of Rowe
Basemap © 2013 Esri

0 250 500
1:5,000 Feet

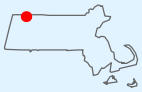
N

SOLITUDE LAKE MANAGEMENT

Water Depth



Pelham Lake
Rowe, MA



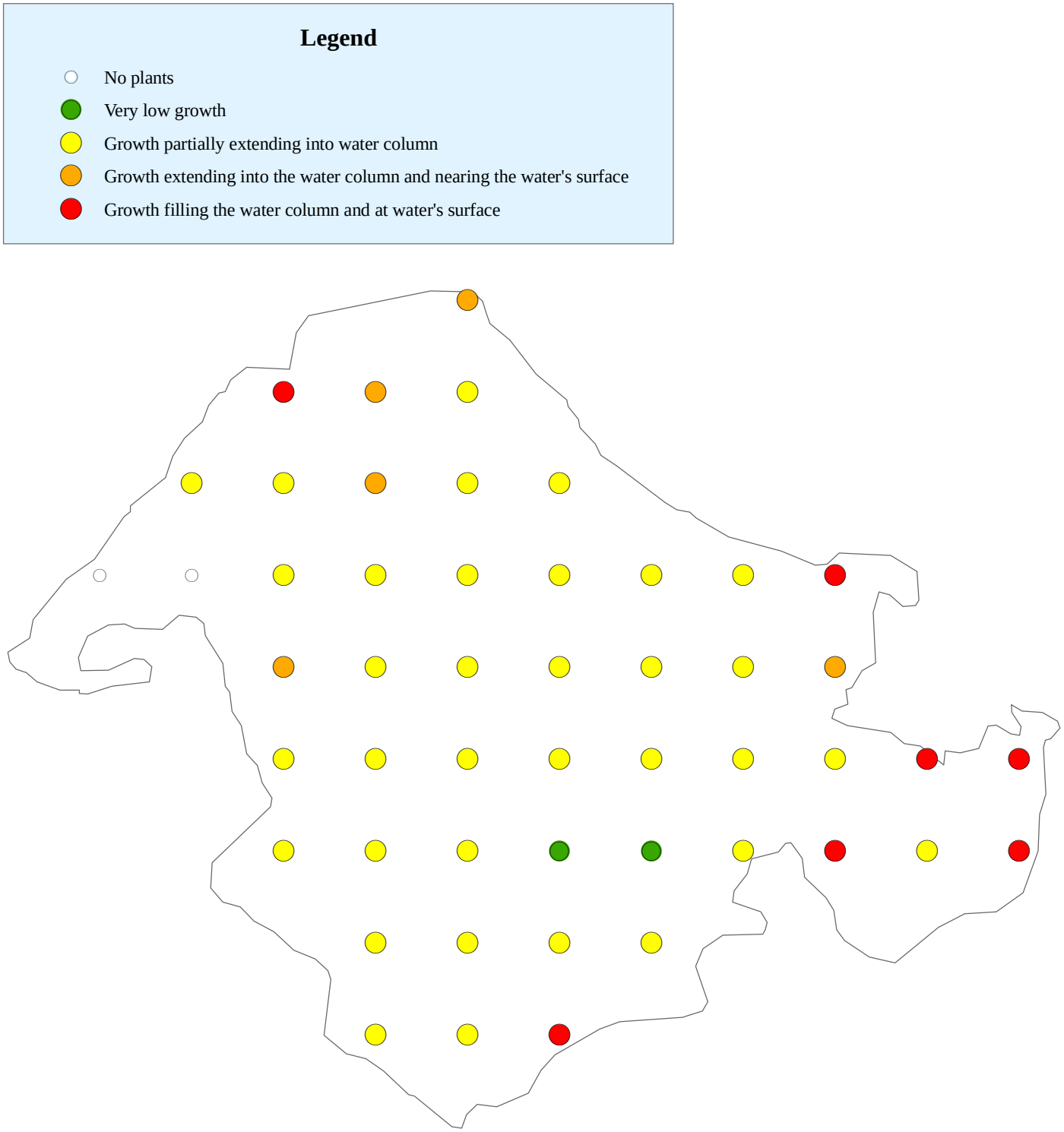
Map Prepared:5/5/15
Date Collected: 8/14 & 8/15/14
For: Town of Rowe
Basemap © 2013 Esri

0 250 500
1:5,000 Feet

N

SOLITUDE LAKE MANAGEMENT

Total Biomass at Individual Survey Points



Pelham Lake
Rowe, MA

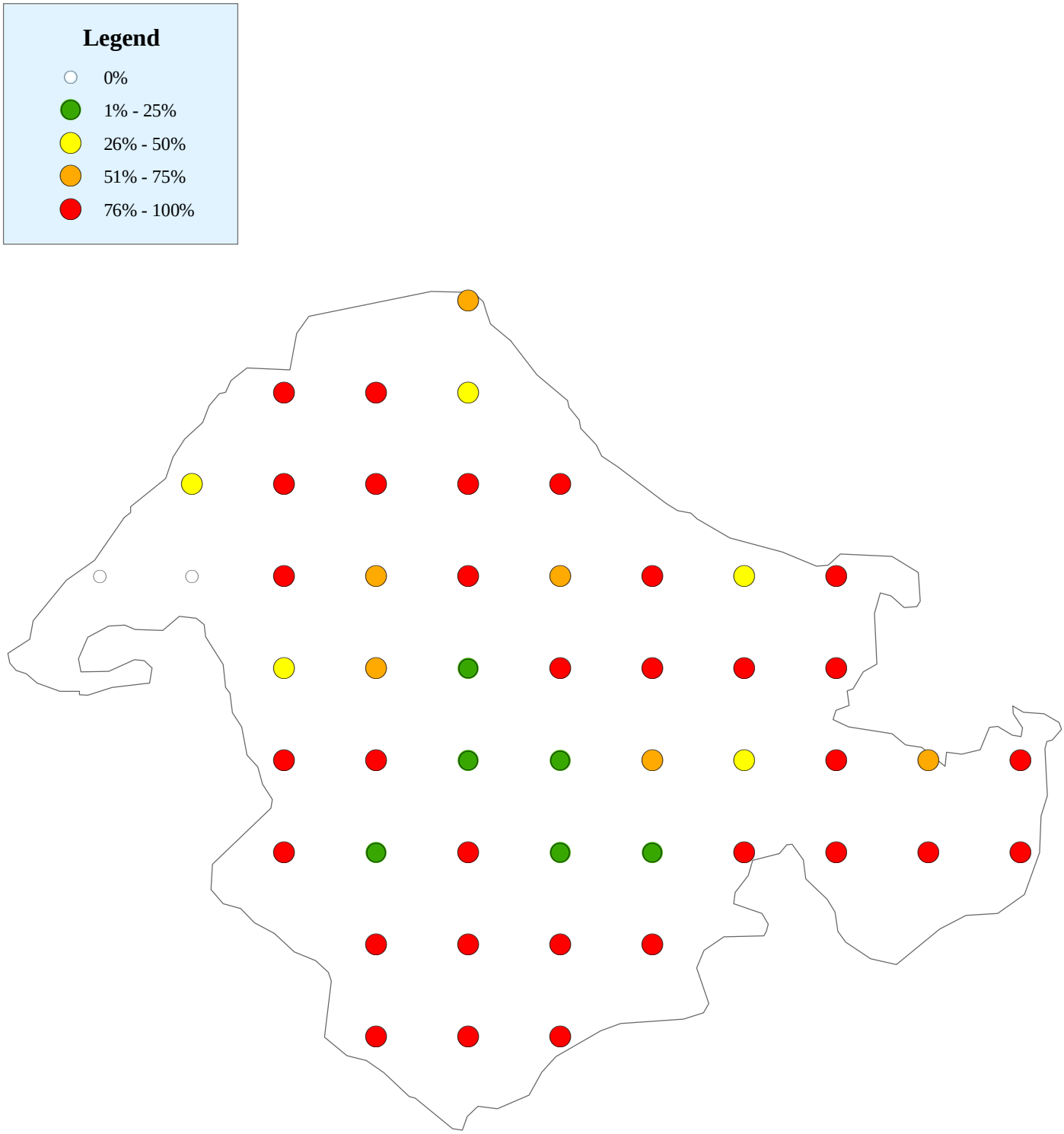
Map Prepared:5/5/15
Date Collected: 8/14 & 8/15/14
For: Town of Rowe
Basemap © 2013 Esri

0 250 500
1:5,000 Feet

N

SOLITUDE LAKE MANAGEMENT

Percent Cover of All Plant Species



Pelham Lake
Rowe, MA

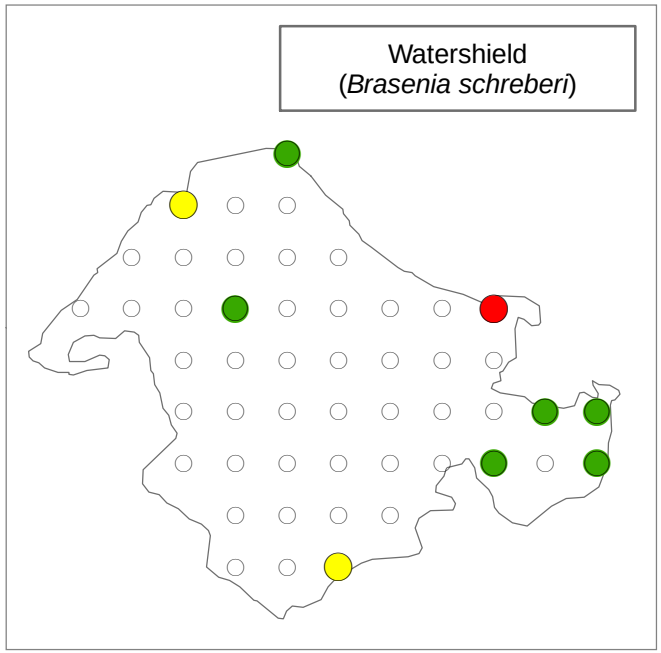
Map Prepared:5/5/15
Date Collected: 8/14 & 8/15/14
For: Town of Rowe
Basemap © 2013 Esri

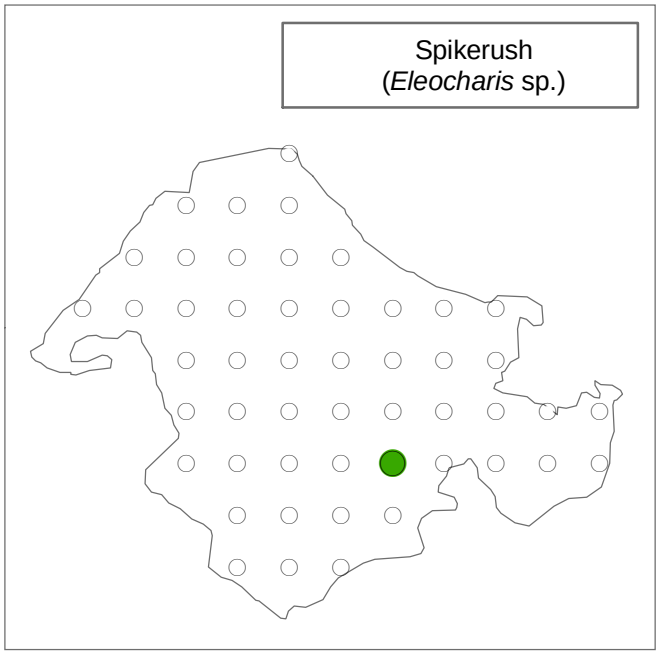
0 250 500
1:5,000 Feet

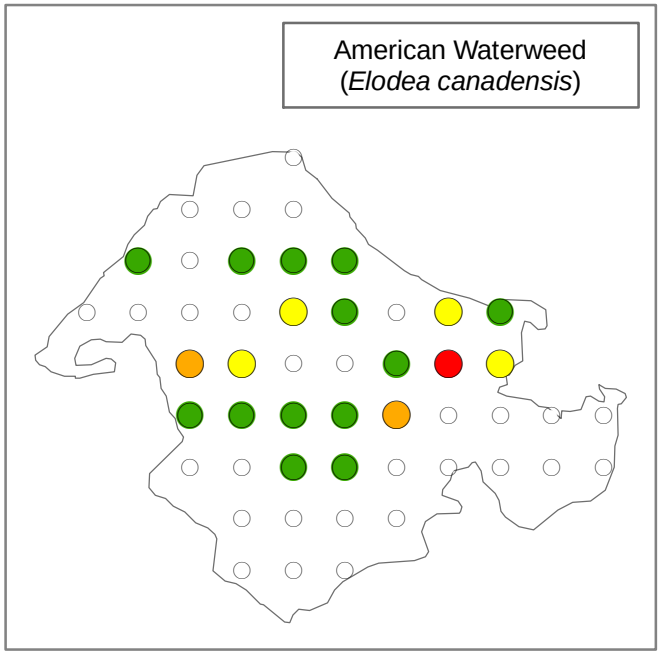
N

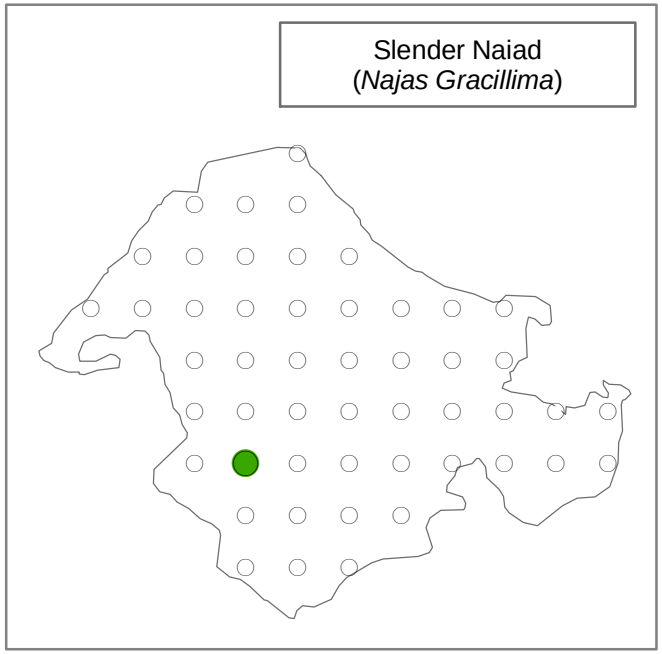
SOLITUDE LAKE MANAGEMENT

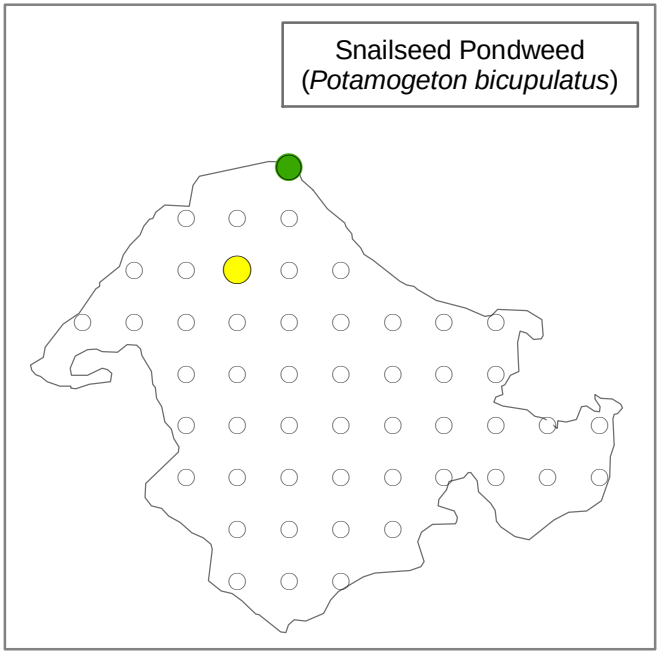
Relative Abundance of Observed Aquatic Vegetation Species (1 of 2)

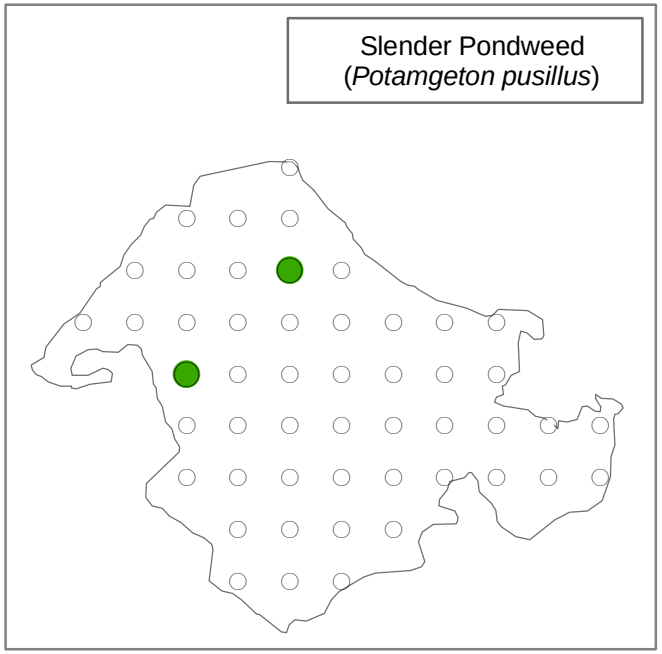




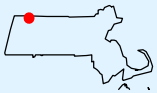








Pelham Lake
Rowe, MA



Data Collected: 08/14/14
Map Prepared:05/01/15
For Town of Rowe (#356-14)
Basemap © 2013 Esri

Legend

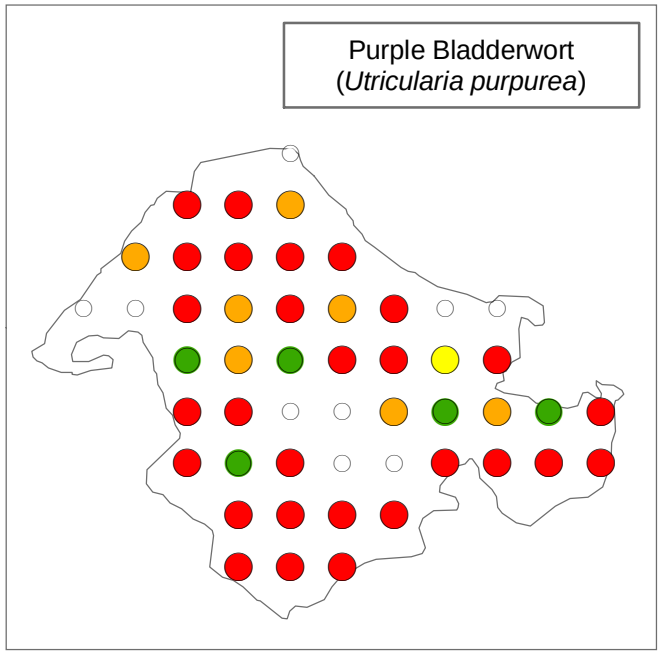
- Zero
- Trace
- Sparse
- Moderate
- Dense

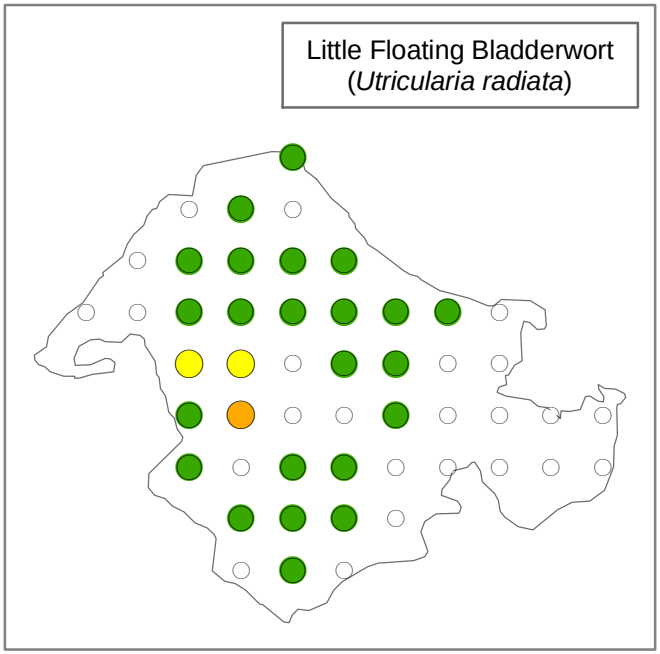
0 500 1,000 1,500
1:11,700 Feet

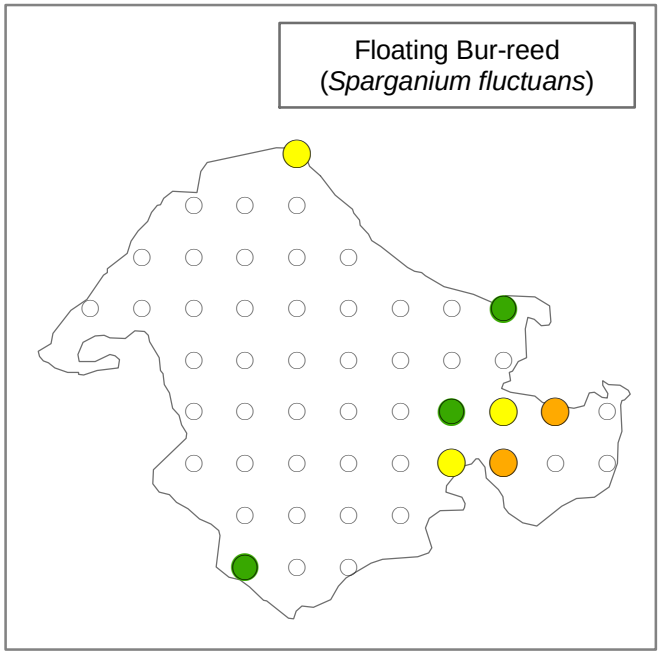
N

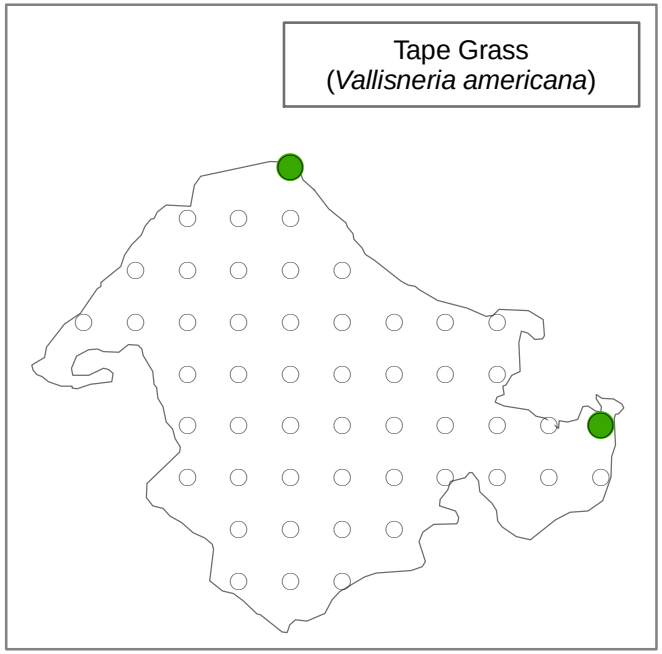
SOLITUDE LAKE MANAGEMENT

Relative Abundance of Observed Aquatic Vegetation Species (2 of 2)









Pelham Lake
Rowe, MA

Data Collected: 08/14/14
Map Prepared:05/01/15
For Town of Rowe (#356-14)
Basemap © 2013 Esri

Legend

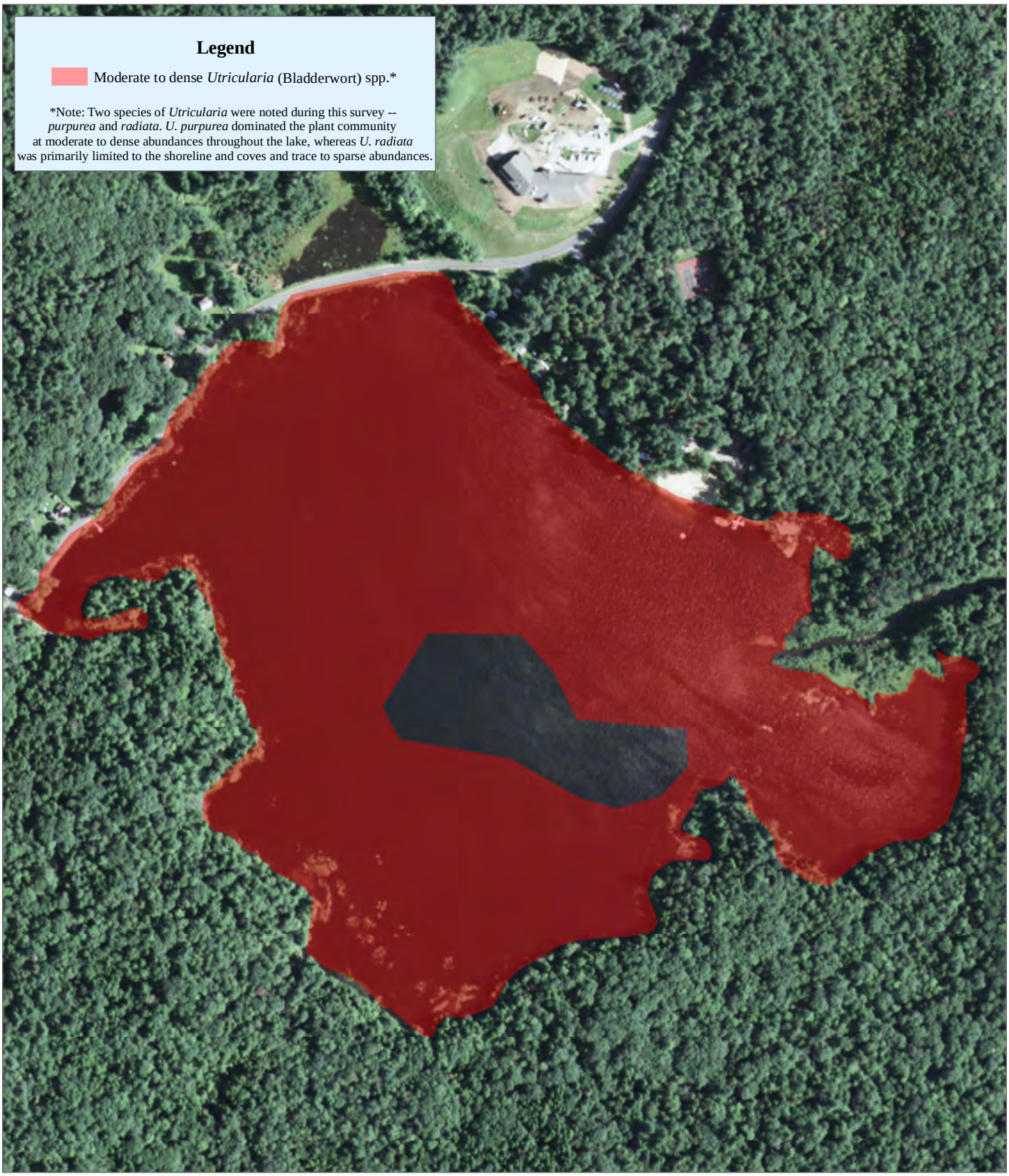
- Zero
- Trace
- Sparse
- Moderate
- Dense

0 500 1,000 1,500
1:11,700 Feet

N

SOLITUDE LAKE MANAGEMENT

2014 July Distribution of *Utricularia* spp.



Pelham Lake
Rowe, MA

Map Prepared:5/5/15
Date Collected: 8/14 & 8/15/14
For: Town of Rowe
Basemap © 2013 Esri

0 250 500
1:5,000 Feet

N

SOLITUDE LAKE MANAGEMENT

Appendix B

Water Quality Sampling Results

- Spectrum Analytical – 10/02/14
- Microbac Laboratory – 06/16/15

Compiled Water Sampling Results & In Situ Data

Report Date:
16-Oct-14 15:23

☑ Final Report
☐ Re-Issued Report
☐ Revised Report

SPECTRUM ANALYTICAL, INC.
Featuring
HANIBAL TECHNOLOGY

Laboratory Report

Lycott Environmental Research
21 West Main St (Route9)
Spencer, MA 01562
Attn: Joy Liptak

Project: Pelham Lake - Rowe, MA
Project #: [none]

Laboratory ID	Client Sample ID	Matrix	Date Sampled	Date Received
SB97444-01	Pelham Lake - 3 - Deep Hole	Surface Water	02-Oct-14 13:45	03-Oct-14 14:15
SB97444-02	Pelham Lake - 4 - Open Water	Surface Water	02-Oct-14 13:38	03-Oct-14 14:15
SB97444-03	Pelham Lake - 2 - Pelham Brook	Surface Water	02-Oct-14 13:53	03-Oct-14 14:15
SB97444-04	Pelham Lake - 1 - Potter Brook	Surface Water	02-Oct-14 13:15	03-Oct-14 14:15
SB97444-05	Pelham Lake - 5 - Storm Drain	Surface Water	02-Oct-14 14:03	03-Oct-14 14:15

I attest that the information contained within the report has been reviewed for accuracy and checked against the quality control requirements for each method. These results relate only to the sample(s) as received.
All applicable NELAC requirements have been met.

Massachusetts # M-MA138/MA1110
Connecticut # PH-0777
Florida # E87600/E87936
Maine # MA138
New Hampshire # 2538
New Jersey # MA011/MA012
New York # 11393/11840
Pennsylvania # 68-04426/68-02924
Rhode Island # 98
USDA # S-51435

Authorized by:

Nicole Leja
Laboratory Director

Spectrum Analytical holds certification in the State of Massachusetts for the analytes as indicated with an X in the "Cert." column within this report. Please note that the State of Massachusetts does not offer certification for all analytes. Please refer to our website for specific certification holdings in each state.
Please note that this report contains 7 pages of analytical data plus Chain of Custody document(s). When the Laboratory Report is indicated as revised, this report supersedes any previously dated reports for the laboratory ID(s) referenced above. Where this report identifies subcontracted analyses, copies of the subcontractor's test report are available upon request. This report may not be reproduced, except in full, without written approval from Spectrum Analytical, Inc.

Spectrum Analytical, Inc. is a NELAC accredited laboratory organization and meets NELAC testing standards. Use of the NELAC logo however does not insure that Spectrum is currently accredited for the specific method or analyte indicated. Please refer to our "Quality" web page at www.spectrum-analytical.com for a full listing of our current certifications and fields of accreditation. States in which Spectrum Analytical, Inc. holds NELAC certification are New York, New Hampshire, New Jersey, Pennsylvania and Florida. All analytical work for Volatile Organic and Air analysis are transferred to and conducted at our 830 Silver Street location (NY-11840, NJ-MA012, PA-68-04426 and FL-E87936).

Please contact the Laboratory or Technical Director at 800-789-9115 with any questions regarding the data contained in this laboratory report.

CASE NARRATIVE:

Data has been reported to the RDL. This report excludes estimated concentrations detected below the RDL and above the MDL (J-Flag).

The samples were received 0.8 degrees Celsius, please refer to the Chain of Custody for details specific to temperature upon receipt. An infrared thermometer with a tolerance of +/- 1.0 degrees Celsius was used immediately upon receipt of the samples.

If a Matrix Spike (MS), Matrix Spike Duplicate (MSD) or Duplicate (DUP) was not requested on the Chain of Custody, method criteria may have been fulfilled with a source sample not of this Sample Delivery Group.

Due to possible microbial action or loss or gain of gases when the sample is exposed to air, the sampling recommendation for alkalinity or acidity suggests a separate bottle filled completely and capped tightly. When possible, testing for alkalinity or acidity is performed as soon as possible from the designated unopened, full container.

There is no relevant protocol-specific QC and/or performance standards non-conformances to report.

Sample Acceptance Check Form

Client:	Lycott Environmental Research
Project:	Pelham Lake - Rowe, MA / [none]
Work Order:	SB97444
Sample(s) received on:	10/3/2014

The following outlines the condition of samples for the attached Chain of Custody upon receipt.

	Yes	No	N/A
1. Were custody seals present?	☐	☑	☐
2. Were custody seals intact?	☐	☐	☑
3. Were samples received at a temperature of ≤ 6°C?	☑	☐	☐
4. Were samples cooled on ice upon transfer to laboratory representative?	☐	☑	☐
5. Were samples refrigerated upon transfer to laboratory representative?	☑	☐	☐
6. Were sample containers received intact?	☑	☐	☐
7. Were samples properly labeled (labels affixed to sample containers and include sample ID, site location, and/or project number and the collection date)?	☑	☐	☐
8. Were samples accompanied by a Chain of Custody document?	☑	☐	☐
9. Does Chain of Custody document include proper, full, and complete documentation, which shall include sample ID, site location, and/or project number, date and time of collection, collector's name, preservation type, sample matrix and any special remarks concerning the sample?	☑	☐	☐
10. Did sample container labels agree with Chain of Custody document?	☑	☐	☐
11. Were samples received within method-specific holding times?	☑	☐	☐

Sample Identification	Client Project #	Matrix	Collection Date/Time	Received
Pelham Lake - 3 - Deep Hole SB97444-01	[none]	Surface Water	02-Oct-14 13:45	03-Oct-14

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
General Chemistry Parameters													
	Total Alkalinity	**8.83**		mg/l CaCO3	4.00	1.05	1	SM2320B	06-Oct-14	06-Oct-14	BD	1423562	X
	Ammonia as N	< 0.200		mg/l	0.200	0.118	1	SM4500-NH3 C.	07-Oct-14	07-Oct-14	EEM	1423636	X
14797-55-8	Nitrate as N	< 0.100		mg/l	0.100	0.0336	1	EPA 300.0	02-Oct-14 18:39	03-Oct-14 21:46	CPA	1423335	X

Sample Identification	Client Project #	Matrix	Collection Date/Time	Received
Pelham Lake - 4 - Open Water SB97444-02	[none]	Surface Water	02-Oct-14 13:38	03-Oct-14

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
General Chemistry Parameters													
	Total Alkalinity	**8.98**		mg/l CaCO3	4.00	1.05	1	SM2320B	06-Oct-14	06-Oct-14	BD	1423562	X
	Ammonia as N	< 0.200		mg/l	0.200	0.118	1	SM4500-NH3 C.	07-Oct-14	07-Oct-14	EEM	1423636	X
14797-55-8	Nitrate as N	< 0.100		mg/l	0.100	0.0336	1	EPA 300.0	02-Oct-14 18:39	03-Oct-14 22:01	CPA	1423335	X

Sample Identification	Client Project #	Matrix	Collection Date/Time	Received
Pelham Lake - 2 - Pelham Brook SB97444-03	[none]	Surface Water	02-Oct-14 13:53	03-Oct-14

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
General Chemistry Parameters													
	Ammonia as N	< 0.200		mg/l	0.200	0.118	1	SM4500-NH3 C.	07-Oct-14	07-Oct-14	EEM	1423636	X
14797-55-8	Nitrate as N	< 0.100		mg/l	0.100	0.0336	1	EPA 300.0	02-Oct-14 18:39	03-Oct-14 22:16	CPA	1423335	X

Sample Identification	Client Project #	Matrix	Collection Date/Time	Received
Pelham Lake - 1 - Potter Brook SB97444-04	[none]	Surface Water	02-Oct-14 13:15	03-Oct-14

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
General Chemistry Parameters													
	Ammonia as N	**0.210**		mg/l	0.200	0.118	1	SM4500-NH3 C.	07-Oct-14	07-Oct-14	EEM	1423636	X
14797-55-8	Nitrate as N	< 0.100		mg/l	0.100	0.0336	1	EPA 300.0	02-Oct-14 18:39	03-Oct-14 22:32	CPA	1423335	X

Sample Identification	Client Project #	Matrix	Collection Date/Time	Received
Pelham Lake - 5 - Storm Drain SB97444-05	[none]	Surface Water	02-Oct-14 14:03	03-Oct-14

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
General Chemistry Parameters													
	Ammonia as N	< 0.200		mg/l	0.200	0.118	1	SM4500-NH3 C.	07-Oct-14	07-Oct-14	EEM	1423636	X
14797-55-8	Nitrate as N	< 0.100		mg/l	0.100	0.0336	1	EPA 300.0	02-Oct-14 18:39	03-Oct-14 22:47	CPA	1423335	X

General Chemistry Parameters - Quality Control

Analyte(s)	Result	Flag	Units	*RDL	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch 1423335 - General Preparation										
Blank (1423335-BLK1)						Prepared: 02-Oct-14	Analyzed: 03-Oct-14			
Nitrate as N	< 0.100		mg/l	0.100						
LCS (1423335-BS1)						Prepared: 02-Oct-14	Analyzed: 03-Oct-14			
Nitrate as N	**1.98**		mg/l	0.100	2.00		99	90-110		
Calibration Blank (1423335-CCB1)						Prepared: 02-Oct-14	Analyzed: 03-Oct-14			
Nitrate as N	**0.00**		mg/l							
Calibration Blank (1423335-CCB2)						Prepared: 02-Oct-14	Analyzed: 03-Oct-14			
Nitrate as N	**0.00**		mg/l							
Calibration Blank (1423335-CCB3)						Prepared: 02-Oct-14	Analyzed: 03-Oct-14			
Nitrate as N	**0.00**		mg/l							
Calibration Blank (1423335-CCB4)						Prepared: 02-Oct-14	Analyzed: 04-Oct-14			
Nitrate as N	**0.00**		mg/l							
Calibration Blank (1423335-CCB5)						Prepared: 02-Oct-14	Analyzed: 04-Oct-14			
Nitrate as N	**0.00**		mg/l							
Calibration Blank (1423335-CCB6)						Prepared: 02-Oct-14	Analyzed: 06-Oct-14			
Nitrate as N	**0.00**		mg/l							
Calibration Blank (1423335-CCB7)						Prepared: 02-Oct-14	Analyzed: 06-Oct-14			
Nitrate as N	**0.00**		mg/l							
Calibration Blank (1423335-CCB8)						Prepared: 02-Oct-14	Analyzed: 06-Oct-14			
Nitrate as N	**0.00**		mg/l							
Calibration Blank (1423335-CCB9)						Prepared: 02-Oct-14	Analyzed: 06-Oct-14			
Nitrate as N	**0.00**		mg/l							
Calibration Check (1423335-CCV1)						Prepared: 02-Oct-14	Analyzed: 03-Oct-14			
Nitrate as N	**1.87**		mg/l	0.100	2.00		93	90-110		
Calibration Check (1423335-CCV2)						Prepared: 02-Oct-14	Analyzed: 03-Oct-14			
Nitrate as N	**1.95**		mg/l	0.100	2.00		97	90-110		
Calibration Check (1423335-CCV3)						Prepared: 02-Oct-14	Analyzed: 03-Oct-14			
Nitrate as N	**1.95**		mg/l	0.100	2.00		98	90-110		
Calibration Check (1423335-CCV4)						Prepared: 02-Oct-14	Analyzed: 04-Oct-14			
Nitrate as N	**1.96**		mg/l	0.100	2.00		98	90-110		
Calibration Check (1423335-CCV5)						Prepared: 02-Oct-14	Analyzed: 04-Oct-14			
Nitrate as N	**1.93**		mg/l	0.100	2.00		97	90-110		
Calibration Check (1423335-CCV6)						Prepared: 02-Oct-14	Analyzed: 06-Oct-14			
Nitrate as N	**1.96**		mg/l	0.100	2.00		98	90-110		
Calibration Check (1423335-CCV7)						Prepared: 02-Oct-14	Analyzed: 06-Oct-14			
Nitrate as N	**1.98**		mg/l	0.100	2.00		99	90-110		
Calibration Check (1423335-CCV8)						Prepared: 02-Oct-14	Analyzed: 06-Oct-14			
Nitrate as N	**1.93**		mg/l	0.100	2.00		96	90-110		
Calibration Check (1423335-CCV9)						Prepared: 02-Oct-14	Analyzed: 06-Oct-14			
Nitrate as N	**1.97**		mg/l	0.100	2.00		99	90-110		
Reference (1423335-SRM1)						Prepared: 02-Oct-14	Analyzed: 03-Oct-14			
Nitrate as N	**2.41**		mg/l	0.100	2.50		97	90-110		
Batch 1423562 - General Preparation										
Blank (1423562-BLK1)						Prepared & Analyzed: 06-Oct-14				
Total Alkalinity	< 4.00		mg/l CaCO3	4.00						
Blank (1423562-BLK2)						Prepared & Analyzed: 06-Oct-14				
Total Alkalinity	< 4.00		mg/l CaCO3	4.00						
Blank (1423562-BLK3)						Prepared & Analyzed: 06-Oct-14				
Total Alkalinity	< 4.00		mg/l CaCO3	4.00						
LCS (1423562-BS1)						Prepared & Analyzed: 06-Oct-14				

General Chemistry Parameters - Quality Control

Analyte(s)	Result	Flag	Units	*RDL	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch 1423562 - General Preparation										
LCS (1423562-BS1)					Prepared & Analyzed: 06-Oct-14					
Total Alkalinity	**52.0**		mg/l CaCO3	4.00	50.0		104	90-110		
LCS (1423562-BS2)					Prepared & Analyzed: 06-Oct-14					
Total Alkalinity	**51.8**		mg/l CaCO3	4.00	50.0		104	90-110		
LCS (1423562-BS3)					Prepared & Analyzed: 06-Oct-14					
Total Alkalinity	**51.9**		mg/l CaCO3	4.00	50.0		104	90-110		
Reference (1423562-SRM1)					Prepared & Analyzed: 06-Oct-14					
Total Alkalinity	**62.3**		mg/l CaCO3	20.0	61.0		102	80-120		
Batch 1423636 - General Preparation										
Blank (1423636-BLK1)					Prepared & Analyzed: 07-Oct-14					
Ammonia as N	< 0.200		mg/l	0.200						
LCS (1423636-BS1)					Prepared & Analyzed: 07-Oct-14					
Ammonia as N	**5.04**		mg/l	0.200	5.00		101	90-110		
Duplicate (1423636-DUP1)			**Source: SB97444-02**		Prepared & Analyzed: 07-Oct-14					
Ammonia as N	**0.140**	J	mg/l	0.200		0.140			0	20
Matrix Spike (1423636-MS1)			**Source: SB97444-01**		Prepared & Analyzed: 07-Oct-14					
Ammonia as N	**5.46**		mg/l	0.200	5.00	BRL	109	80-120		
Reference (1423636-SRM1)					Prepared & Analyzed: 07-Oct-14					
Ammonia as N	**1.75**		mg/l	0.200	1.92		91	84-116		

Notes and Definitions

dry	Sample results reported on a dry weight basis
NR	Not Reported
RPD	Relative Percent Difference
J	Detected but below the Reporting Limit; therefore, result is an estimated concentration (CLP J-Flag).

Laboratory Control Sample (LCS): A known matrix spiked with compound(s) representative of the target analytes, which is used to document laboratory performance.

Matrix Duplicate: An intra-laboratory split sample which is used to document the precision of a method in a given sample matrix.

Matrix Spike: An aliquot of a sample spiked with a known concentration of target analyte(s). The spiking occurs prior to sample preparation and analysis. A matrix spike is used to document the bias of a method in a given sample matrix.

Method Blank: An analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank should be carried through the complete sample preparation and analytical procedure. The method blank is used to document contamination resulting from the analytical process.

Method Detection Limit (MDL): The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix type containing the analyte.

Reportable Detection Limit (RDL): The lowest concentration that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. For many analytes the RDL analyte concentration is selected as the lowest non-zero standard in the calibration curve. While the RDL is approximately 5 to 10 times the MDL, the RDL for each sample takes into account the sample volume/weight, extract/digestate volume, cleanup procedures and, if applicable, dry weight correction. Sample RDLs are highly matrix-dependent.

Surrogate: An organic compound which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which is not normally found in environmental samples. These compounds are spiked into all blanks, standards, and samples prior to analysis. Percent recoveries are calculated for each surrogate.

Continuing Calibration Verification: The calibration relationship established during the initial calibration must be verified at periodic intervals. Concentrations, intervals, and criteria are method specific.

Validated by:
June O'Connor

SB 97444 By

SPECTRUM ANALYTICAL, INC.
Featuring
HANIBAL TECHNOLOGY

CHAIN OF CUSTODY RECORD

Page 1 of 1

Special Handling:

- [x] Standard TAT - 7 to 10 business days
- [ ] Rush TAT - Date Needed: _____

All TATs subject to laboratory approval
Min. 24-hr notification needed for rushes
Samples disposed after 60 days unless otherwise instructed.

Report To: Lycott Environmental
21 West Main Street
Spencer, MA 01562

Telephone #: 508-885-0101
Project Mgr:

Invoice To: Lycott Environmental
21 West Main Street
Spencer, MA 01562

P.O No.: _____ Quote/RQN: _____

Project No:
Site Name: Pelham Lake
Location: Rowe State: MA
Sampler(s): EK

F=Field Filtered 1=Na_2S2O_3 2=HCl 3=H_2SO_4 4=HNO_3 5=NaOH 6=Ascorbic Acid
7=CH3OH 8=$NaHSO_4$ 9=Deionized Water 10=H_3PO_4 11= cool to ≤6°C 12= _____

DW=Dinking Water GW=Groundwater SW=Surface Water WW=Waste Water
O=Oil SO=Soil SL=Sludge A=Indoor/Ambient Air SG=Soil Gas
X1= _____ X2= _____ X3= _____

G= Grab C=Compsite

Lab ID:	Sample ID:	Date:	Time:	Type	Matrix	# of VOA Vials	# of Amber Glass	# of Clear Glass	# of Plastic		Nitrogen, Nitrate	Ammonia, Nitrogen	Total Alkalinity						Check if chlorinated
						Containers					Analysis								
											List Preservative Code below:								
											11	3, 11	11						
97444-01	Pelham Lake - 3 - Deep Hole	10/2/2014	1:45 PM	G	SW				3		x	x	x						☐
02	Pelham Lake - 4 - Open Water	10/2/2014	1:38 PM	G	SW				3		x	x	x						☐
03	Pelham Lake - 2 - Pelham Brook	10/2/2014	1:53 PM	G	SW				2		x	x							☐
04	Pelham Lake - 1 - Potter Brook	10/2/2014	1:15 PM	G	SW				2		x	x							☐
05	Pelham Lake - 5 - Storm Drain	10/2/2014	2:03 PM	G	SW				2		x	x							☐
																			☐
																			☐
																			☐
																			☐
																			☐

QA/QC Reporting Notes:
* additional charges may appply

MA DEP MCP CAM Report? ☐ Yes ☐ No
CT DPH RCP Report? ☐ Yes ☐ No
- [x] Standard
- [ ] No QC
- [ ] DQA*
- [ ] ASP A*
- [ ] ASP B*
- [ ] NJ Reduced*
- [ ] NJ Full*
- [ ] Tier II*
- [ ] Tier IV*
- [ ] Other: _____

State-specific reporting standards:

Relinquished by:	Received by:	Date:	Time:	Temp °C
Rebecca Snyder	[illegible]	10/3/14	10:35 AM	Observed 0.8
[illegible]	JM	10/3/14	1415	Correction Factor 0
				Corrected 0.8
				IR ID # 11

- [ ] EDD format:
- [x] E-mail to: info@lycott.com

Condition upon receipt: Custody Seals: ☐ Present ☐ Intact ☐ Broken
☐ Ambient ☐ Iced ☑ Refrigerated ☐ DI VOA Frozen ☐ Soil Jar Frozen

61 Louisa Viens Drive
Dayville, CT 06241
Fax: 860-774-2689
Phone: 860-774-6814
Toll-Free: 800-334-0103

RECEIVED JUN 25 2015

ANALYTICAL DATA REPORT

prepared for:

Aquatic Control Technology
21 West Main St.
Spencer , MA 01562
Nancy McGann

Report Number: E506K10
Project: Pelham Lake

Received Date: 06/17/2015
Report Date: 06/24/2015

David Dickinson
Technical Director

CT DPH #PH-0465 EPA #CT00008 MA DEP #M-CT008 ME DHHS #CT0050 NH ELAP #2020
NY ELAP #11549 PA DEP #68-04413 RI DOH #LAO00346 VT DOH #VT11549

101-000000463269

61 Louisa Viens Drive
Dayville, CT 06241
Fax: 860-774-2689
Phone: 860-774-6814
Toll-Free: 800-334-0103

Report No: E506K10
Client: Aquatic Controls Technology
Project: Pelham Lake

CASE NARRATIVE / METHOD CONFORMANCE SUMMARY

The results presented in this report relate only to the samples received.

This report is incomplete unless all pages indicated in the pagination at the bottom of the page are included, along with a copy of the chain of custody and any subcontracted analyses reports, if applicable, for the sample(s) in this report. Subcontractor results are identified by 'SUB' next to the analysis.

Microbac Laboratories, Inc. received five samples from Aquatic Controls Technology on 06/17/2015. The samples were analyzed for the following list of analyses in accordance with MA DEP regulations unless otherwise indicated:

Alkalinity, Total by SM2320B in DW/WW
SM2320B
Nitrate as N by SM4500-NO3 F in DW/WW
SM4500-NO3-F
Ammonia as N by 350.1 in WW
350.1[350.2]
Phosphorus, Total as P by 365.1 in DW/WW
365.1[365.1]

Non-Conformances:

Work Order:

None

Sample:

None

Analysis:

None

Microbac Laboratories, Inc.
Analytical Data Report

Report No: E506K10
Date Received: 06/17/2015 14:15

Customer: Aquatic Controls Technology
Project: Pelham Lake

Parameter	Result	DL	Units	Completed	By	Dilution
(1) Pelham Lake - 1						
Date Collected: 06/16/2015 12:00	**Matrix: Aqueous**					
Alkalinity by SM2320B	3.6	1.0	mg/L	06/19/2015 15:49	ST	
Ammonia as N by 350.1	0.051	0.050	mg/L	06/23/2015 14:39	JJT	
Nitrate as N by SM4500-NO3 F	ND	0.050	mg/L	06/17/2015 18:00	DCH	
Phosphorus as P by 365.1	ND	0.010	mg/L	06/18/2015 09:23	JJT	
(2) Pelham Lake - 2						
Date Collected: 06/16/2015 12:00	**Matrix: Aqueous**					
Alkalinity by SM2320B	4.1	1.0	mg/L	06/19/2015 15:49	ST	
Ammonia as N by 350.1	0.071	0.050	mg/L	06/23/2015 13:08	JJT	
Nitrate as N by SM4500-NO3 F	ND	0.050	mg/L	06/17/2015 18:05	DCH	
Phosphorus as P by 365.1	0.015	0.010	mg/L	06/18/2015 09:24	JJT	
(3) Pelham Lake - 3						
Date Collected: 06/16/2015 12:00	**Matrix: Aqueous**					
Alkalinity by SM2320B	3.1	1.0	mg/L	06/19/2015 15:49	ST	
Ammonia as N by 350.1	ND	0.050	mg/L	06/23/2015 13:09	JJT	
Nitrate as N by SM4500-NO3 F	ND	0.050	mg/L	06/17/2015 18:06	DCH	
Phosphorus as P by 365.1	0.012	0.010	mg/L	06/18/2015 09:24	JJT	
(4) Pelham Lake - 4						
Date Collected: 06/16/2015 12:00	**Matrix: Aqueous**					
Alkalinity by SM2320B	3.6	1.0	mg/L	06/19/2015 15:49	ST	
Ammonia as N by 350.1	0.16	0.050	mg/L	06/23/2015 13:10	JJT	
Nitrate as N by SM4500-NO3 F	ND	0.050	mg/L	06/17/2015 18:08	DCH	
Phosphorus as P by 365.1	ND	0.010	mg/L	06/18/2015 09:25	JJT	
(5) Pelham Lake - 5						
Date Collected: 06/16/2015 12:00	**Matrix: Aqueous**					
Alkalinity by SM2320B	4.1	1.0	mg/L	06/19/2015 15:49	ST	
Ammonia as N by 350.1	0.051	0.050	mg/L	06/23/2015 13:11	JJT	
Nitrate as N by SM4500-NO3 F	ND	0.050	mg/L	06/17/2015 18:09	DCH	
Phosphorus as P by 365.1	0.010	0.010	mg/L	06/18/2015 09:25	JJT	

MICROBAC

Microbac Laboratories, Inc.

CHAIN OF CUSTODY FORM

61 Louisa Viens Drive - Dayville, CT 06241
Tel: (860)774-6814 - Fax: (860)774-2689

FOR LAB USE ONLY

Lab WO# B506K10

Project Manager LAL

Copy of Report To

CUSTOMER: Aquatic Control Technology c/o Marc Bellaud
ADDRESS: 21 West Main Street
Spencer, MA 01562
DELIVERY:
E-MAIL: info@aquaticcontroltech.com
PHONE: 508-885-0101 FAX: 774-745-0277

Billing Information

BILL TO: Aquatic Control Technology c/o Marc Bellaud
ADDRESS: 21 West Main Street
Spencer, MA 01562
PURCHASE ORDER #
ATTENTION:
PHONE:

Project Information

PROJECT: Pelham Lake
LOCATION: Rowe, MA
Y QUESTIONS WHEN SAMPLES ARRIVE WE SHOULD CA
PHONE:
FAX:

Sample Identification	Date Collected	Time Collected	Sample Type: COMPOSITE	Sample Type: GRAB	Sample Matrix	Number of Bottles	Analysis: Total Phosphorus	Analysis: Ammonia, Nitrogen	Analysis: Nitrate, Nitrogen	Analysis: Alkalnity	Analysis:	Analysis:	Analysis:	Analysis:	Analysis:	Analysis:	Analysis:	Preservatives: NON-PRES	Preservatives: HS2O4	Preservatives: HCL	Preservatives: HNO3	Preservatives: OTHER
Pelham Lake - 1	6/16/2015	12:00		X	SW	4	1	1	1	1								2	2			
Pelham Lake - 2	6/16/2015	12:00		X	SW	4	1	1	1	1								2	2			
Pelham Lake - 3	6/16/2015	12:00		X	SW	4	1	1	1	1								2	2			
Pelham Lake - 4	6/16/2015	12:00		X	SW	4	1	1	1	1								2	2			
Pelham Lake - 5	6/16/2015	12:00		X	SW	4	1	1	1	1								2	2			

PRESERVATIVE VERIFIED Initials

CUSTODY TRANSFER	DATE	TIME
SAMPLER: AM	6/16/15	
RECEIVED:		
RELINQUISHED: Nancy Mc Hann	6/17/15	12:29 PM
RECEIVED: C Tuttle	6/17/15	12:30
RELINQUISHED: C Tuttle	6/17/15	1415
RECEIVED: Michael Noble	6/17/15	1415

TURN AROUND (INDICATE IN CALENDAR DAYS):

FAX ☐ HARD COPY ☐ E-MAIL ☐

EXPIDATED SERVICE MAY BE SUBJECT TO SURCHARGE

COMMENTS:

CONDITIONS UPON RECEIPT (CHECK ONE): COMPLIANT ☐

COOLED ☑ AMBIENT ☐ 3.2

Date	Location	Alkalinity (mg/L)	Ammonia (mg/L)	Nitrate (mg/L)	Phosphorus (mg/L)	pH	Temperature (ºC)	Dissolved Oxygen (mg/L)	Secchi (m)
10/2/2014	1 - Potter Brook		0.210	<0.100		7.0	13.3	8.49	
10/2/2014	2 - Pelham Brook		<0.200	<0.100		7.0	17.9	8.20	
10/2/2014	3 - Deep Hole	8.83	<0.200	<0.100		7.0	17.3	8.13	2.75
10/2/2014	4 - Open Water	8.98	<0.200	<0.100		7.0	17.3	8.42	2.5
10/2/2014	5 - Storm Drain		<0.200	<0.100		7.0	17.0	8.05	
6/16/2015	1 - Potter Brook	3.6	0.051	<0.050	<0.010				
6/16/2015	2 - Pelham Brook	4.1	0.071	<0.050	0.015				
6/16/2015	3 - Deep Hole	3.1	<0.050	<0.050	0.012	7.0	22.2	7.53	2.75
6/16/2015	4 - Open Water	3.6	0.160	<0.050	<0.010				
6/16/2015	5 - Storm Drain	4.1	0.051	<0.050	0.010				

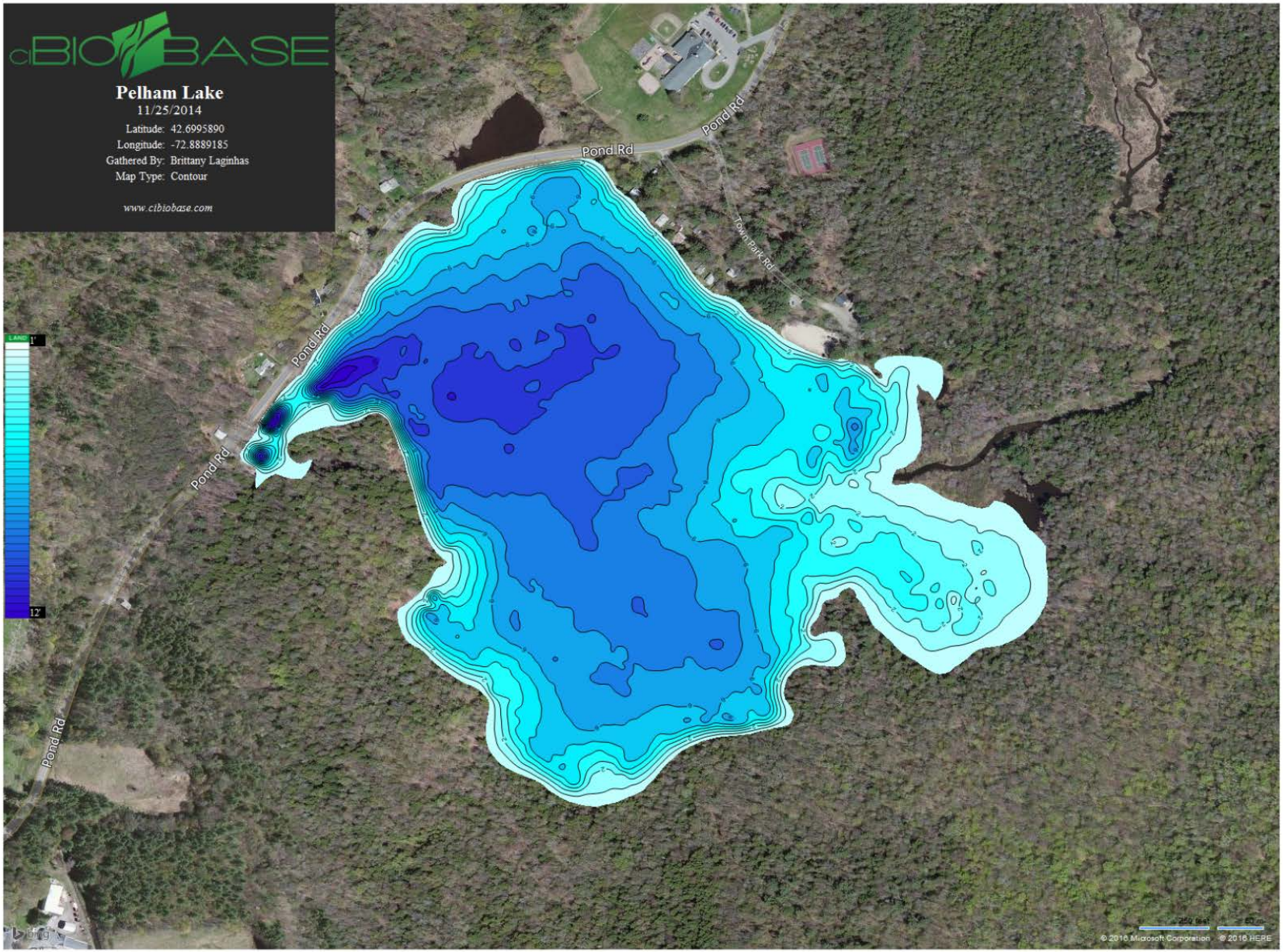
*Note: all empty boxes indicate that samples were not analyzed for that parameter.
Alkalinity, ammonia, nitrate, and phosphorus were analyzed by a certified laboratory; pH, temperature, dissolved oxygen and secchi were measured in situ.

Appendix C

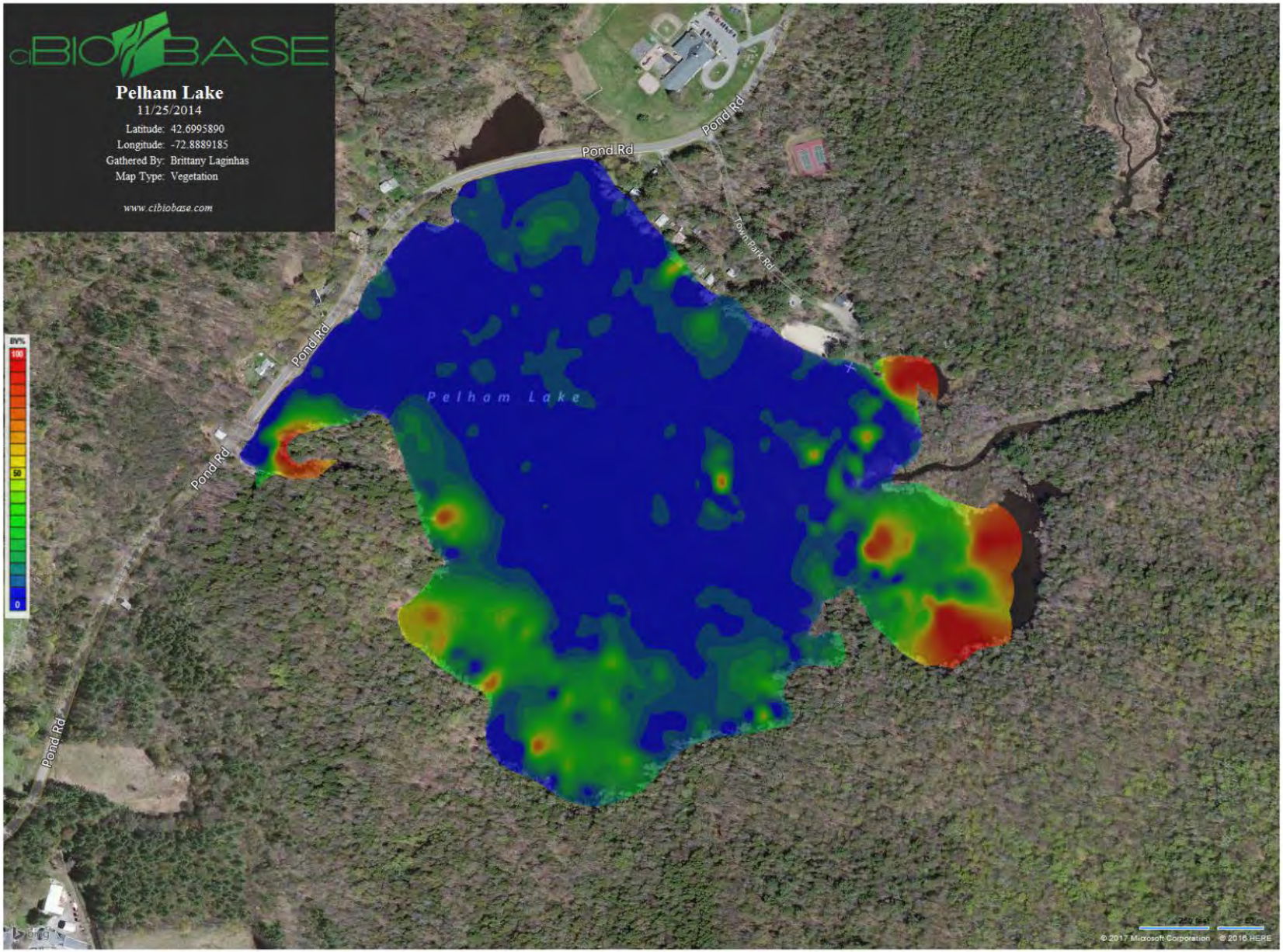
ciBioBase Survey Maps

- Bathymetric map
- Biovolume map

Bathymetric Map



Biovolume Map



Appendix D

Padgett Environmental Surveys

- 2010 Report
- 2015 Report

RECEIVED AUG 20 2010

Botanical Survey
of
Pelham Lake
Rowe, Massachusetts

By

Donald J. Padgett, Ph.D.

Padgett Environmental Services
40 Chadderton Way
Middleboro, MA 02346

For

Town of Rowe
Parks & Recreation Department

&

Lycott Environmental, Inc.
600 Charlton St.
Southbridge, MA 01550

August 2010

Described herein is a report of botanical surveys for the rare Farwell's Water-Milfoil (*Myriophyllum farwellii*) within Pelham Lake, Franklin Co., Massachusetts. This species is imperiled in Massachusetts and currently listed as "endangered". This survey was mandated by MA Natural Heritage & Endangered Species Program to help minimize any rare species impacts during proposed lake management activities.

Methods

In compliance with MA Natural Heritage survey protocol, all suitable habitats (i.e., shallow pond margins) of the target species were assessed during the current growing season, over an appropriate period for diagnostic material (Fig. 1). An effort was made to inventory all the vascular plants encountered in the lake and to describe the plant communities.

The lake was surveyed by canoe on two occasions, initially on 16 Jul 2010 and subsequently on 17 Aug 2010. Prior to the surveys, I examined the *Myriophyllum farwellii* collections of the Hodgedon Herbarium (Univ. New Hampshire), Olney Herbarium (Brown University), and Bridgewater State University to aid my preparation and proper identification. During all site visits I was assisted by Jeff Carboni.

When species were difficult to diagnose in the field, fragments were collected and later identified or confirmed. All determinations were made using Crow & Hellquist (*Aquatic and Wetland Plants of Northeastern North America*), Gleason & Cronquist (*Manual of Vascular Plants of Northeastern United States and Adjacent Canada*), and/or Magee & Ahles (*Flora of the Northeast*) as references. All nomenclature is that adopted by Sorrie & Somers (*The Vascular Plants of Massachusetts: A County Checklist*). For *Myriophyllum* specimens, Hellquist and Crow (*Aquatic Vascular Plants of New England*, Part 6) was also consulted.

Findings

Pelham Lake is a moderate-sized (71 acres) freshwater lake with a small section of shore that serves as a public bathing beach (Fig. 1). The northwestern bank directly borders Pond Road and a northeastern portion is developed with a few homes and cottages, while the beach portion of

the pond is a managed sandy shore and picnic area. The remaining (majority) shoreline and surrounding area is wooded and undeveloped. The open water is used for recreational purposes.

Most of the water body is open (Fig. 2), but the surrounding shores, particularly the shallow coves, support a dense floating-leaf community and submerged plant community. Floating-leaved species identified in the survey area include *Brasenia schreberi, Sparganium fluctuans, Potamogeton epihydrus, Nuphar variegata* and *Nymphaea odorata* (Fig 3). Populations of *Brasenia schreberi* were particularly dense within areas of the large southeastern cove (south of Tuttle Brook) of the lake (Fig 4).

A submersed plant community was present more or less throughout the survey area (Figs. 5-6). Submersed species include *Potamogeton epihydrus, P. bicupulatus, Utricularia purpurea, U. radiata, Najas gracillima,* and *Scirpus subterminalis*. The most common species, and most abundant, was *Utricularia purpurea*. A few emergent species were observed along the shores and included *Typha latifolia, Dulichium arundinaceum, Lythrum salicaria, Sagittaria latifolia, Carex* sp. and *Eleocharis* sp. (Fig 7). The wooded transitional edge around most of the survey area included *Spiraea alba, Acer rubrum, Alnus rugosa, Osmunda regalis*, and *Triadenum purpurea*.

Target species: Consistent with earlier records, *Myriophyllum farwellii* was observed in the lake. This species was confirmed at four separate areas—all within west-facing protected coves (Fig. 8). Water depths at plant locations ranged from 15 cm to 60 cm. Every colony had plants with abundant fruits and individuals appeared to be healthy. All colonies were considered dense (Fig 9).

All four confirmed occurrences of *Myriophyllum farwellii* were diagnosed by their submerged scattered- alternate leaves, lack of emersed foliage, and axillary fruits with distinct tuberculate ridges (Fig. 10). Only the shallow, protected coves of the lake appear to be suitable habitat for this species. Species associated with *Myriophyllum farwellii* included *Brasenia schreberi, Sparganium fluctuans, Utricularia purpurea, U. radiata, Potamogeton epihydrus, Nuphar variegata,* and *Nymphaea odorata*.

Conservation recommendations: Immediate threats to *Myriophyllum farwellii* in Pelham Lake are not obvious other than inadvertent damage by recreational activities. Potential threats would include lake eutrophication, sedimentation/accretion, and/or competition from other aquatic plants. Individuals on the eastern side of the lake, i.e., flanking Tuttle Brook to the north and south, were noticeably covered with fine organic material (see Fig 9). Beaver activity in and around Tuttle Brook purportedly results in a sediment discharge into the lake. A noticeable

broad "sand bar" exists where the brook enters the lake. As for competition, *Brasenia schreberi* provided a very dense floating-leaf cover at places near the colonies and *Utricularia pupurea* & *U. radiata* were very dense throughout the shallow coves. Fortunately, no invasive aquatic species were identified anywhere in the lake and only a few individuals of *Lythrum salicaria* were observed along the shoreline. Lake management strategies (e.g., mechanical harvesting or herbicide use) should avoid the protected coves of the lake if possible.

Conclusions

Individuals of Farwell's Water-milfoil (*Myriophyllum farwellii*) were observed at four localities during comprehensive surveys of Pelham Lake in July-August 2010. These populations appeared to be healthy and reproductive. An effort should be made to protect these populations of an otherwise rare species.

Figure 1. General survey area (hashed lines) of Pelham Lake, Franklin Co., MA.

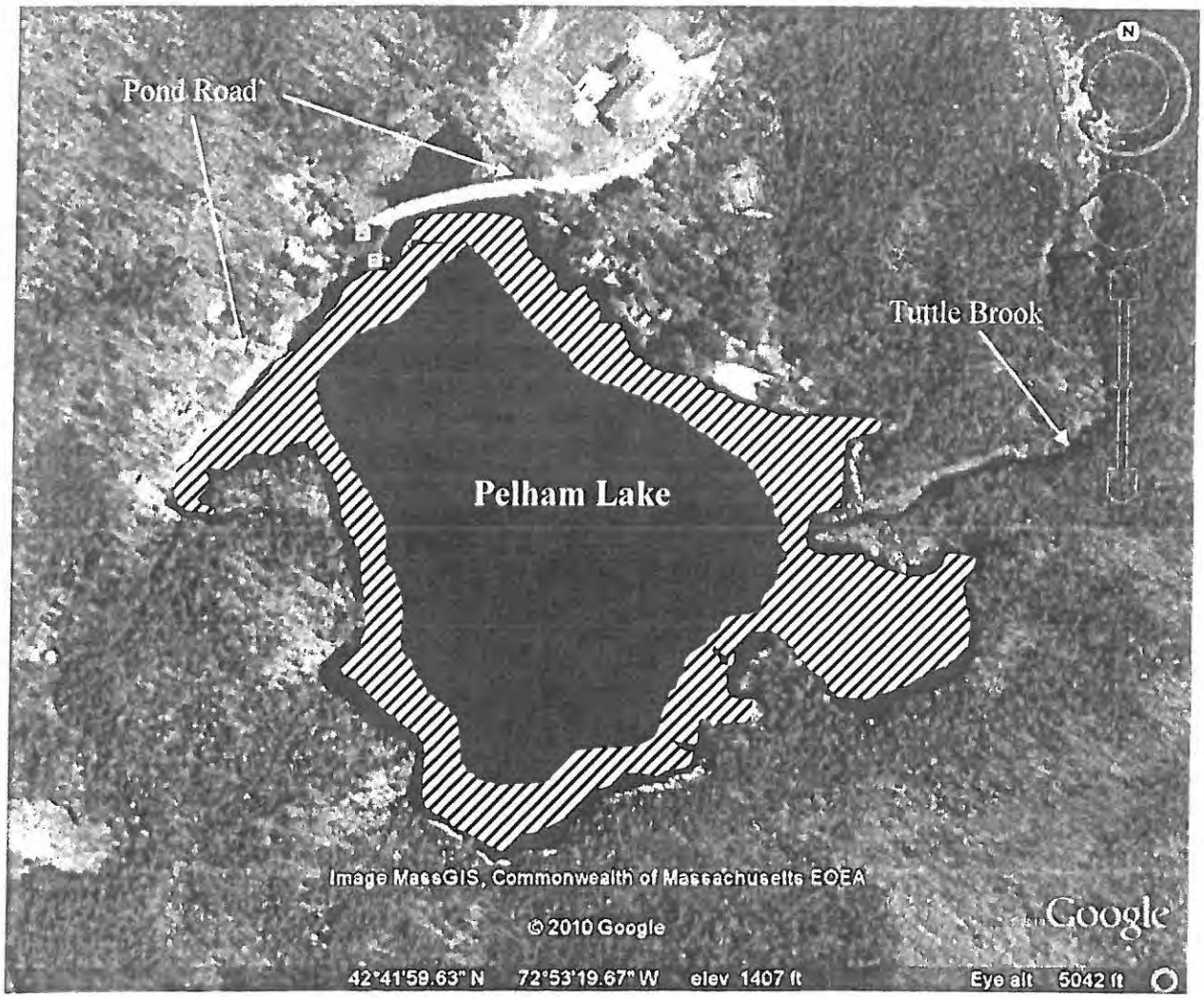


Figure 2. Open water of Pelham Lake (17 Aug 2010). Photo facing northwest.

Figure 3. Floating-leaved community in small cove of Lake Pelham Lake (16 Jul 2010) just southeast of bathing beach. Photo facing northwest

Figure 4. Floating-leaved community in large eastern cove of Pelham Lake south of Tuttle Brook (16 Jul 2010). Photo facing southwest

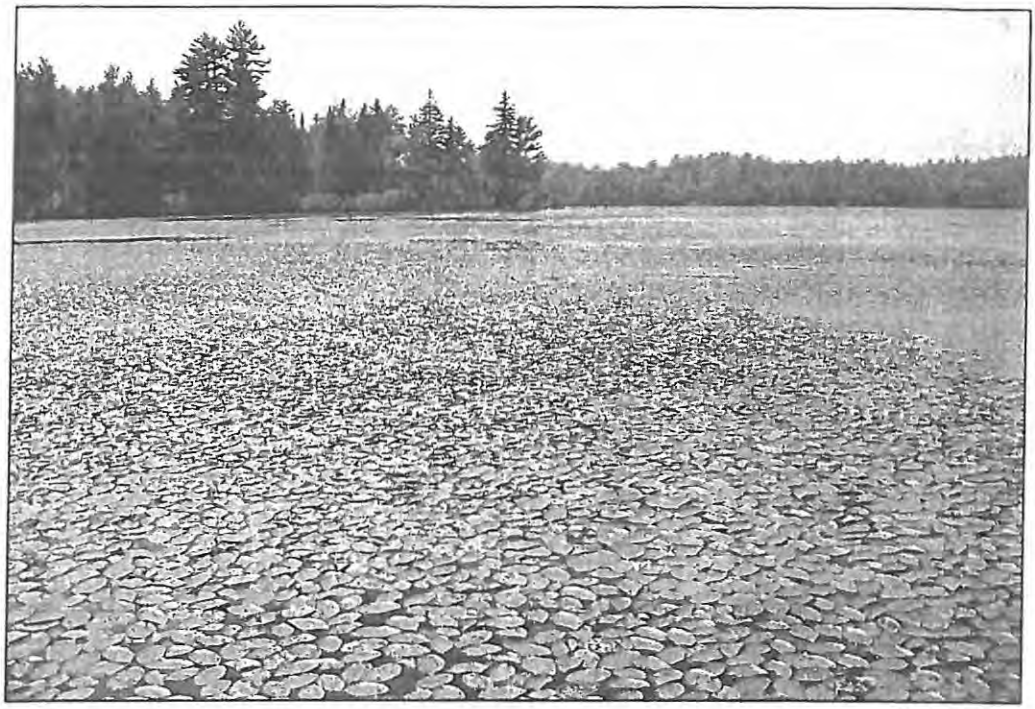


Figure 5. Abundant submerged vegetation in Pelham Lake (17 Aug 2010). Photo facing north with Pond Road in background.

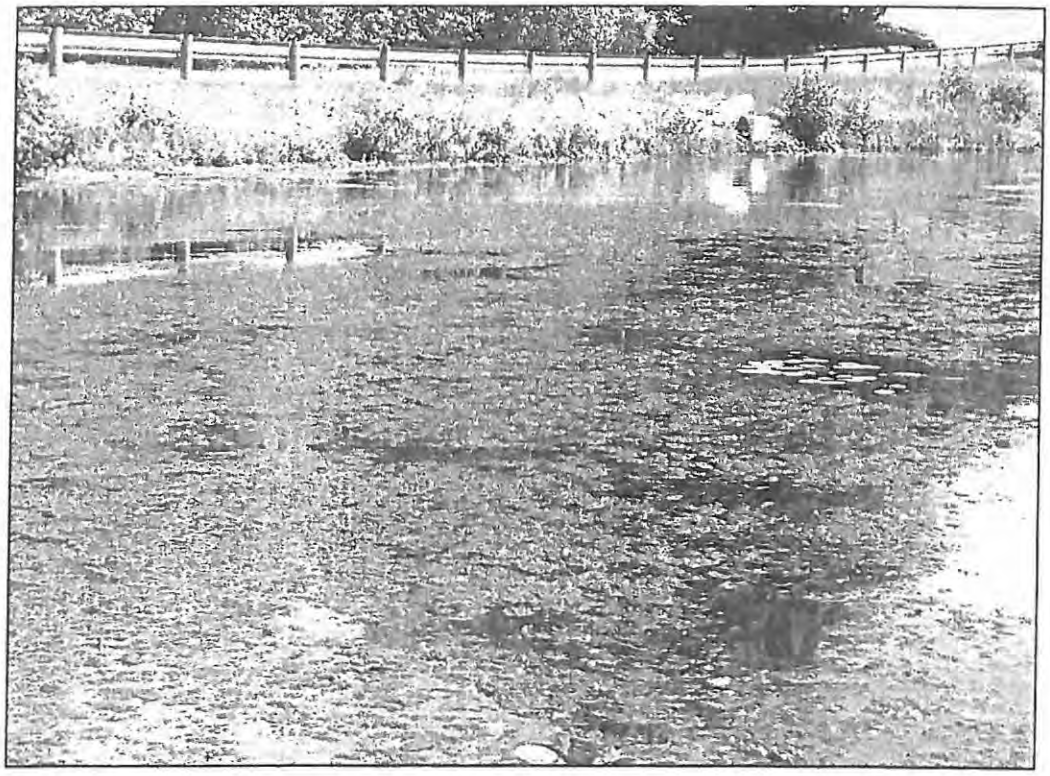


Figure 6. Abundant submerged *Utricularia* in portion of large eastern cove (south of Tuttle Brook) of Pelham Lake (16 Jul 2010). Photo facing east.

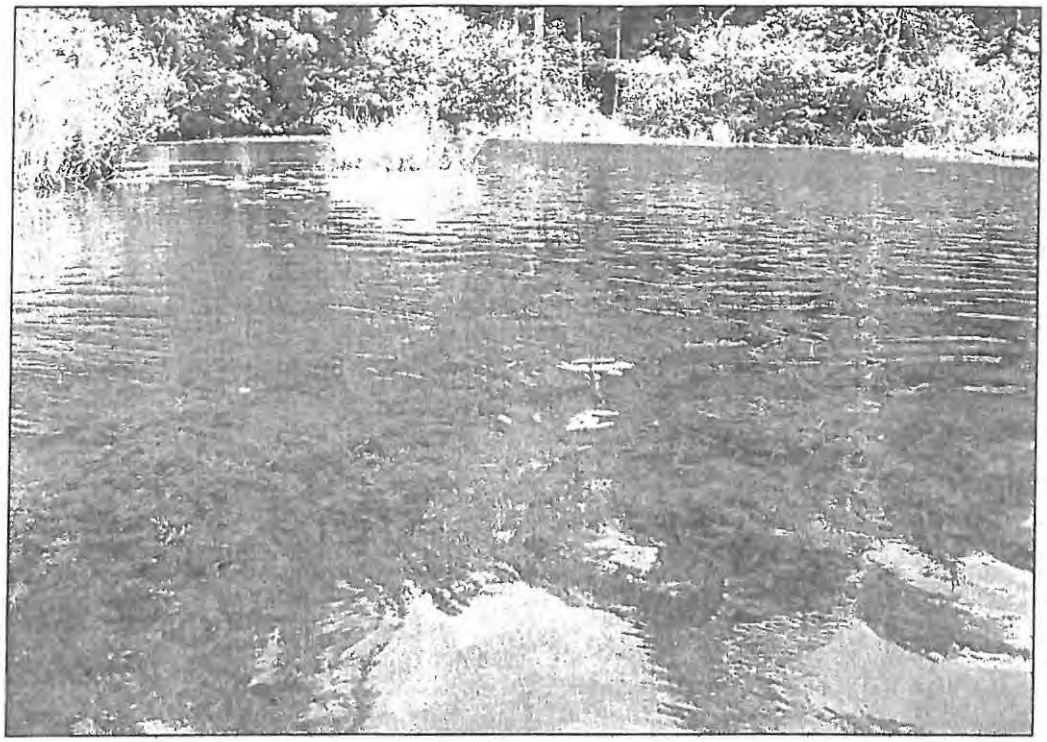
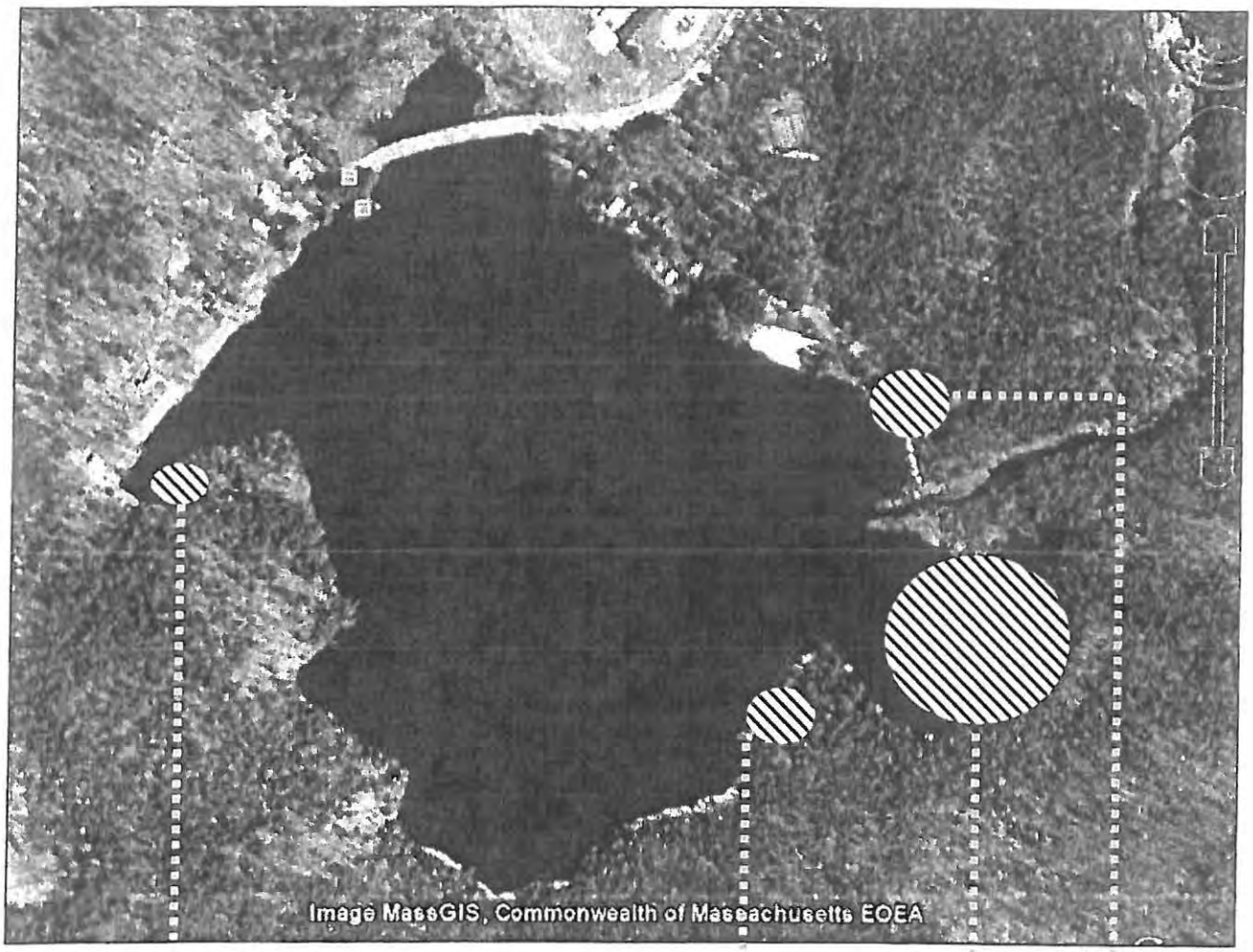


Figure 7. Emergent shoreline in small eastern cove (north of Tuttle Brook) of Pelham Lake (16 Jul 2010). Photo facing north.

Figure 8. Observation areas (hashed lines) of *Myriophyllum farwellii* in four, shallow, protected coves of Pelham Lake.



42° 41.957 N
072° 53.624 W

42° 41.863 N
072° 53.182 W

42° 41.955 N
072° 53.081 W...

42° 41.866 N
072° 53.178 W

42° 42.078 N
072° 53.146 W

Figure 9. Documentation of *Myriophyllum farwellii* in Pelham Lake (16 Jul 2010). Plants covered in a fine organic material.

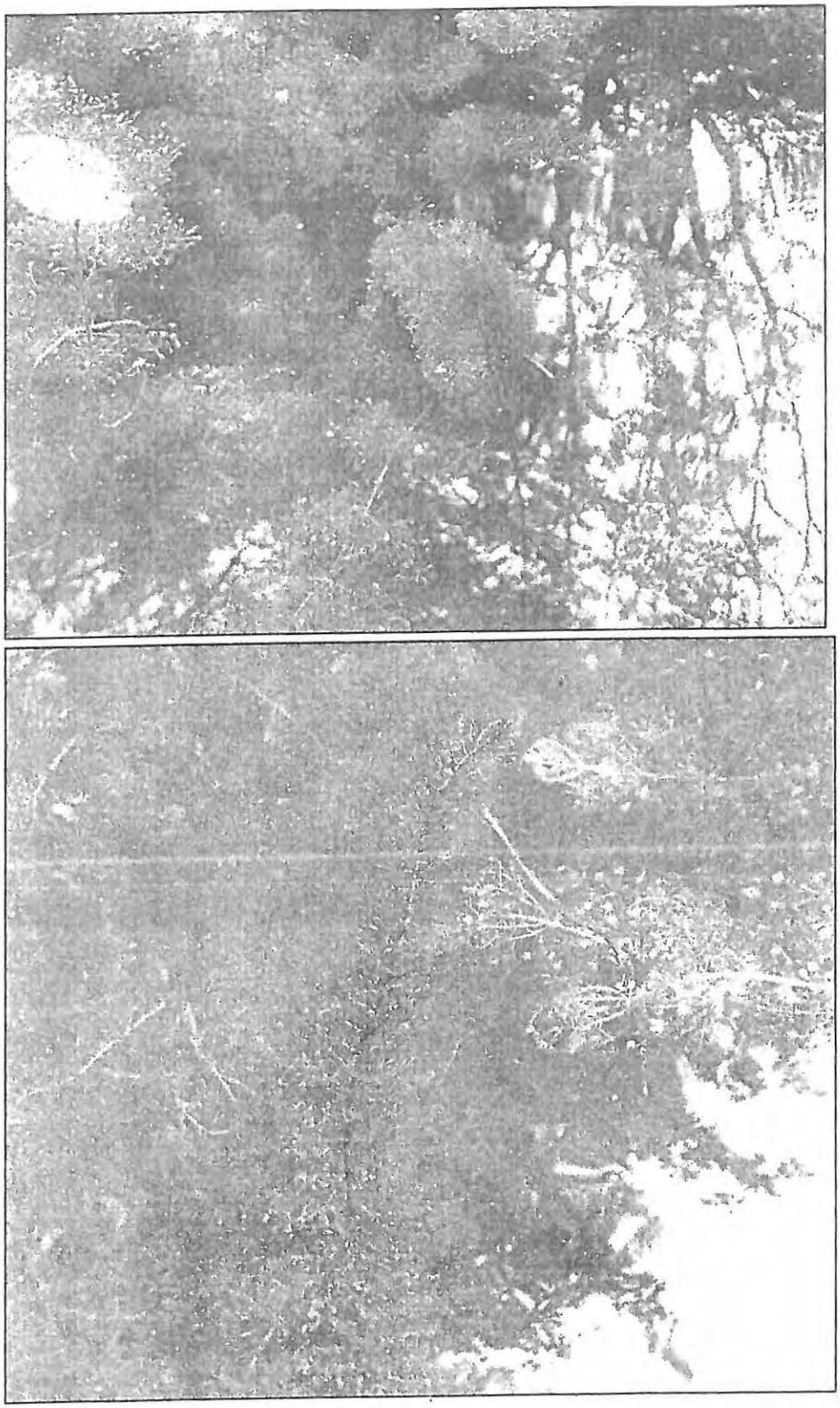
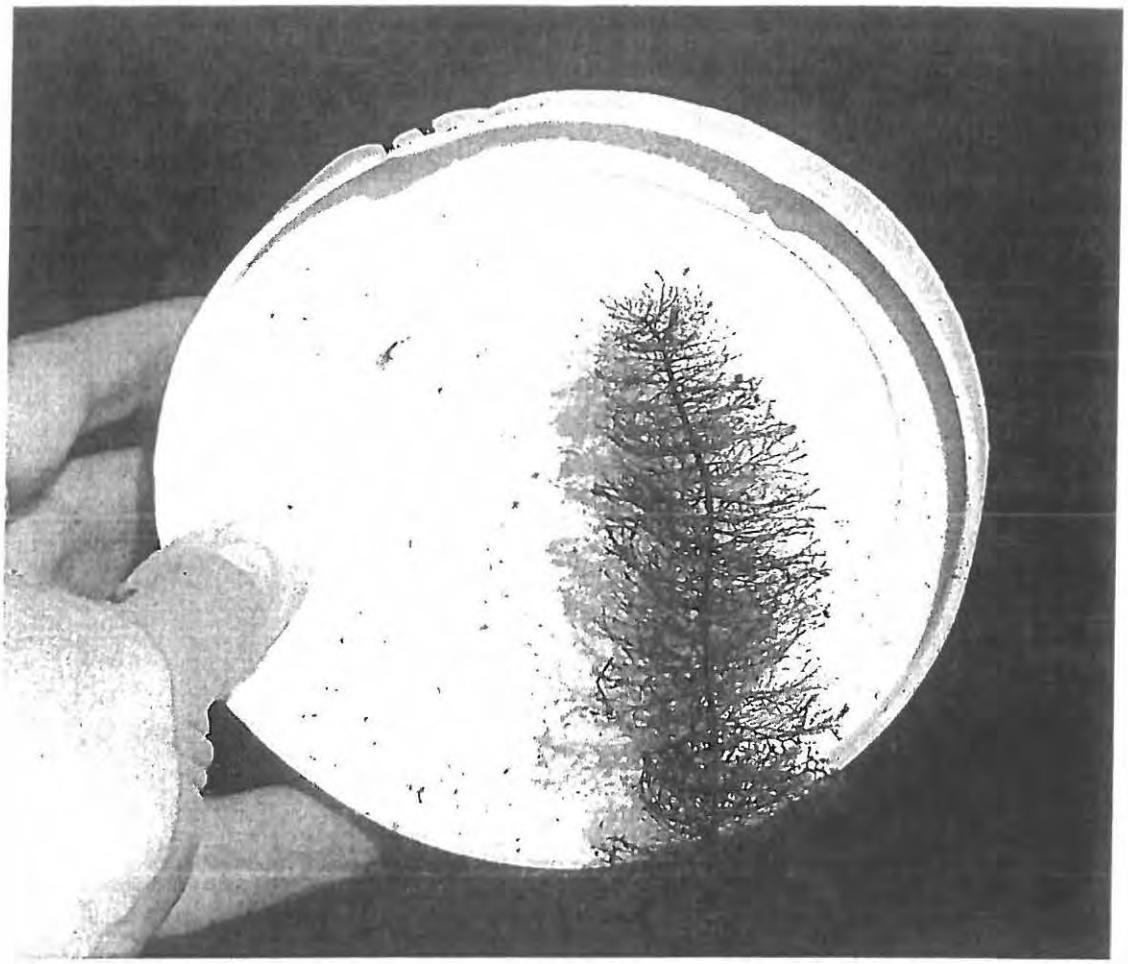


Figure 10. Documentation of *Myriophyllum farwellii* in Pelham Lake (16 Jul 2010).



Botanical Survey
of
Pelham Lake
Rowe, Massachusetts

By

Donald J. Padgett, Ph.D.

Padgett Environmental Services
40 Chadderton Way
Middleboro, MA 02346

For

Town of Rowe
Parks & Recreation Department

&

Aquatic Control Technology, LLC
11 John Road
Sutton, MA 01590

August 2015

Described herein is a report of a botanical survey for the rare Farwell's Water-Milfoil (*Myriophyllum farwellii*) within Pelham Lake, Franklin Co., Massachusetts. This species is imperiled in Massachusetts and currently listed as "endangered". This survey was mandated by MA Natural Heritage & Endangered Species Program (#10-28527) to help minimize any rare species impacts during proposed lake management activities.

Methods

In compliance with MA Natural Heritage survey protocol, all suitable habitats (i.e., shallow pond margins) of the target species were assessed during the current growing season, over an appropriate period for diagnostic material (Fig. 1). An effort was made to inventory all the vascular plants encountered in the lake and to describe the plant communities. The lake was surveyed by canoe on 26 Aug 2015 and certain areas surveyed twice. When the target species was observed, the depth of individuals below the water line were measured. The depth between the water line and the substrate was recorded.

When species were difficult to diagnose in the field, fragments were collected and later identified or confirmed. All determinations were made using Crow & Hellquist (*Aquatic and Wetland Plants of Northeastern North America*), Gleason & Cronquist (*Manual of Vascular Plants of Northeastern United States and Adjacent Canada*), and/or Magee & Ahles (*Flora of the Northeast*) as references. All nomenclature is that adopted by Dow Cullina, et al. (*The Vascular Plants of Massachusetts: A County Checklist*). For *Myriophyllum* specimens, Hellquist and Crow (*Aquatic Vascular Plants of New England*, Part 6) was also consulted.

Findings

Pelham Lake is a moderate-sized (71 acres) freshwater lake with a small section of shore that serves as a public bathing beach (Fig. 1). The northwestern bank directly borders Pond Road and a northeastern portion is developed with a few homes and cottages, while the beach portion of the pond is a managed sandy shore and picnic area. The remaining (majority) shoreline and surrounding area is wooded and undeveloped. The open water is used for recreational purposes.

Most of the water body is open (Fig. 2), but the surrounding shores, particularly the shallow coves, support a dense floating-leaf community and submerged plant community. Floating-leaved species identified in the survey area include *Brasenia schreberi, Nymphoides cordata, Sparganium fluctuans*, *Potamogeton epihydrus*, *Nuphar variegata* and *Nymphaea odorata* (Figs 3-4). Populations of *Brasenia schreberi* were particularly dense within areas of the large southeastern cove (south of Tuttle Brook) of the lake (Fig 3).

A submersed plant community was present more or less throughout the survey area (Fig. 5). Submersed species include *Potamogeton epihydrus, P. bicupulatus*, *Utricularia purpurea, U. radiata*, *Najas gracillima,* and *Scirpus subterminalis*. The most common species, and most abundant, was *Utricularia purpurea*. A few emergent species were observed along the shores and included *Typha latifolia, Dulichium arundinaceum, Lythrum salicaria, Sagittaria latifolia, Carex* sp. and *Eleocharis* sp. The wooded transitional edge around most of the survey area included *Ilex mucronata*, *Spiraea alba*, *Viburnum nudum*, *Acer rubrum*, *Alnus incana*, *Osmunda regalis*, and *Triadenum purpurea*.

Target species: Consistent with earlier records, *Myriophyllum farwellii* was observed in the lake. The species was confirmed at a single area—a protected cove on the western shore adjacent to the spillway/outlet (Fig. 6). Water depths at plant locations ranged from 7 cm to 16 cm, with a mean of 10.92 cm (n=7). This colony had plants with mature fruits and individuals appeared to be healthy (Fig 7). The colony was estimated to contain about 20 individuals. This occurrence of *M. farwellii* was diagnosed by its submerged scattered-alternate leaves, lack of emersed foliage, and axillary fruits with distinct tuberculate ridges (Fig. 7). It was the only species of *Myriophyllum* observed in the lake. Species associated with *Myriophyllum farwellii* included *Brasenia schreberi, Sparganium fluctuans*, *Utricularia purpurea, Potamogeton epihydrus*, *Nuphar variegata,* and *Nymphaea odorata*.

The shallow, protected coves of Pelham Lake appear to be suitable habitat for this species. However, in comparison to the 2010 survey data, the current extent of *Myriophyllum farwellii* is evidently reduced (Fig. 8). Not finding the species in the three additional coves on the eastern shore, as it was in 2010, was surprising. Surveys of these three other coves were repeated multiple times on 26 Aug 2015, but the species appears to no longer occupy these regions or otherwise is reduced in quantity/plant size to the point where individuals were overlooked.

Conservation recommendations: Immediate threats to *Myriophyllum farwellii* in Pelham Lake are not obvious other than inadvertent damage by recreational activities. Potential threats

would include lake eutrophication, sedimentation/accretion, water level manipulation, and/or competition from other aquatic plants. As for competition, *Brasenia schreberi* provided a dense floating-leaf cover at places near the colony and *Utricularia pupurea* was also very dense. Fortunately, no invasive aquatic species were identified in the lake (A few individuals of *Lythrum salicaria* were observed along the shoreline). Considering the apparent constriction of the species' distribution in Pelham Lake (compared to 2010), lake management strategies (e.g., mechanical harvesting or herbicide use) should avoid the lone protected cove where the species was found. This cove is particularly shallow—and contained relatively few individuals—so any drawdown strategy should also be carefully considered. As found in 2010, individuals of *Utricularia* on the eastern side of the lake, i.e., flanking Tuttle Brook to the north and south—where *M. farwellii* used to exist—were noticeably covered with fine organic material (Fig. 9). In 2010, individuals of *M. farwellii* were also reported to have this same covering. Perhaps this material has caused the presumed local extinction of the plants in those coves.

Conclusions

Individuals of Farwell's Water-milfoil (*Myriophyllum farwellii*) were observed at one locality during a comprehensive survey of Pelham Lake in late August 2015. This population was small, but appeared to be healthy and reproductive. An effort should be made to protect this population of an otherwise rare species.

Figure 1. General survey area (hashed lines) of Pelham Lake, Franklin Co., MA.

Figure 2. Open water of Pelham Lake (26 Aug 2015). Photo facing northeast.

Figure 3. Floating-leaved community in small cove of Pelham Lake (26 Aug 2015) just southeast of bathing beach. Photo facing northwest

Figure 4. Floating-leaved community in Pelham Lake adjacent to Pond Road (26 August 2015). Photo facing southwest

Figure 5. Abundant submerged vegetation in Pelham Lake (26 Aug 2015). Vegetation covered in fine organic matter.

Figure 6. Occurences of *Myriophyllum farwellii* in Pelham Lake, Rowe, MA. 26 August 2015

Figure 7. Documentation of *Myriophyllum farwellii* in Pelham Lake (26 Aug 2015).

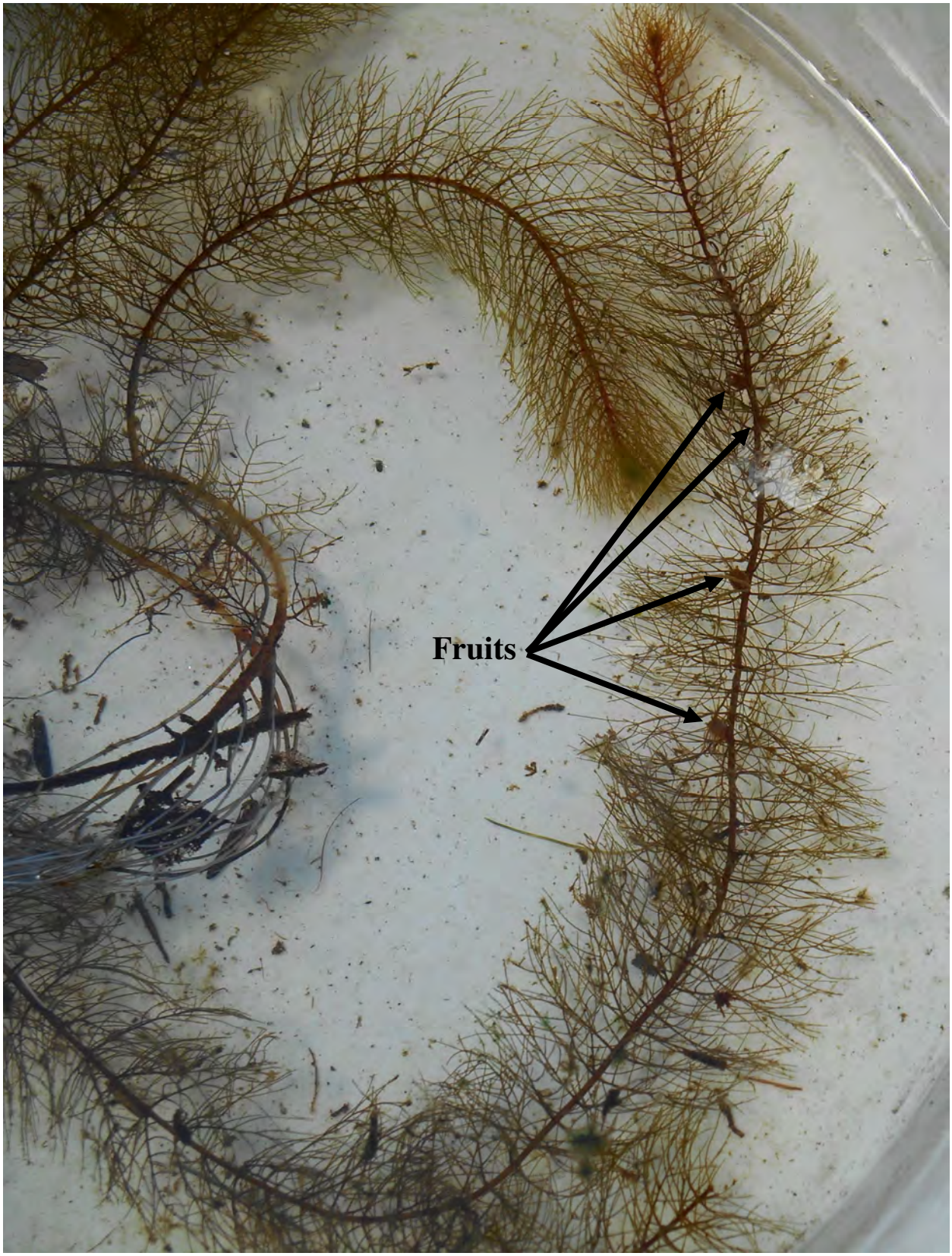


Figure 8. Observation areas (hashed lines) of *Myriophyllum farwellii* in Pelham Lake in 2010.

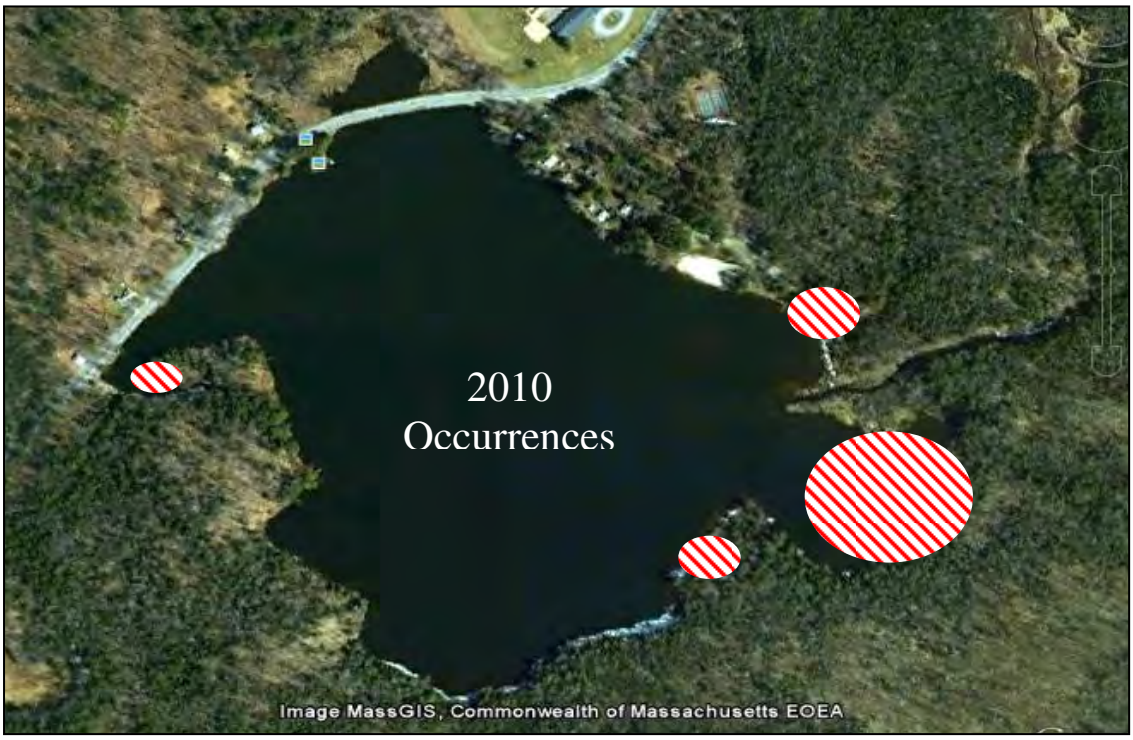


Figure 9. Abundant fine organic material covering submersed *Utricularia* (26 Aug 2015).